

Subterranea

December 2007 Issue 15

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In This Issue...

Boulby Potash Mine

Geneva Excursion

Bunkers in Latvia

Sub Brit Study Weekend - Cumbria

Books, News and Reviews

The Magazine of Subterranea Britannica

www.subbrit.org.uk



Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War/ The main focus of interest is on abandoned and forgotten structures and in the case of Cold War structures studies are entirely confined to declassified and decommissioned structures. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from Newspapers and magazines.

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Front cover photo: Winder at the top of the Honister Incline
Rear cover photo Top: 7.5cm Gun at Fort Cindey, Switzerland
Rear cover photo Bottom: Map Room in Latvian Government Bunker
Pictures by Nick Catford

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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the editor etc. are welcome. However the editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the editor do not necessarily agree with any views expressed and cannot check the accuracy of any material sent in.

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The Subterranea Britannica Committee: Change 'At The Top'

Under the Society's constitution, all officers and members of the committee automatically resign at each Annual General Meeting, but are eligible for re-election.

Paul Sowan, who has occupied the chair for some years, has intimated that he will not stand for re-election to that post at the 2008 AGM; but that he would be willing to serve as an ordinary member of the committee, and to continue to serve the Society much as before, other than acting as chairman. He had advised his willingness to stand down a year or two ago, and has recently commented that as there are now existing committee members both able and willing to serve in his place, this is the time to go!

Paul Sowan has been a member of Subterranea Britannica since 1975, the year after the Society was founded, and has previously served as Secretary. Amongst his contributions to Subterranea Britannica's progress has been his influence in broadening its terms of reference to include mines and underground quarries; and canal, railway and road tunnels. Following the termination of the Cold War, he has happily presided over the expansion of our interests into declassified military and Cold War sites.

He worked on previous and current versions of our constitution, and is at present helping recast this, with small changes, in the form of a Memorandum and Articles

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events:-

15 March 2008 - Hack Green

April 2008

"Subterranea" 16 published** Copy deadline 15 March **

12 April 2008

AGM and Spring Day Conference Royal School of Mines, London

Saturday 24th – Monday 26th May *** *provisional dates* ***

SB Trip to France – maybe Paris or Northern France

August 2008

"Subterranea" 17 published** Copy deadline 15 July **

Friday 5th – Monday 8th September 2008*** *provisional dates* ***

Study Weekend, East Yorkshire

October 2008** *date to be confirmed* **

Autumn Day Conference, ** *location to be confirmed* **

December 2008

"Subterranea" 18 published** Copy deadline 15 November **

General events :-

21-24 March 2008 *** *to be confirmed* *** AIA, Ironbridge Weekend

4 – 6 July 2008 NAMHO conference EDINBURGH

No date yet Hidden Earth

11th – 14th September 2008 Heritage Open Days

20th – 21st September 2008 London Open House



of Association in connection with the creation of a company with liability limited by guarantee, to be known as Subterranea Britannica Ltd.

Subterranea Britannica Ltd.

Your Committee, in line with previous AGM decisions, proposes to set up as soon as is feasible a company without share capital with liability limited by guarantee, to be known as Subterranea Britannica Limited. This would be a legally distinct entity, the existing society having the status of an unincorporated association. In due course, hopefully at the 2008 AGM, it will be proposed that the present Society should be incorporated, and its assets transferred to Subterranea Britannica Limited. All members wishing to be members of the new incorporated Society would be legally required to guarantee that in the event of the company being wound up with assets insufficient to meet its liabilities, they will pay a maximum of £1 each to settle such debts. It is increasingly common for voluntary associations to take such a step, to limit the legal liabilities of their members, committee members, and officers.

Subsequently, again in line with AGM resolutions, it is intended to register the Society, as a Charity or as a Charitable Incorporated Organisation.

Subterranea Britannica Handbook

The first Subterranea Britannica Members' *Handbook* should reach all members before the end of the year.

The Subterranea Britannica Collection: Cold War Photographs

A group of 40 members of Subterranea Britannica has purchased (for the sum of £ 3,600) a large collection of photographs of Cold War and cognate structures, and some associated documentation, with the express purpose of donating it to the Society. Ownership of and responsibility for the safe-keeping and curation of this material was accepted on behalf of Subterranea Britannica by the Committee at its meeting in 30th September 2007.

Initially referred to as the 'Holmpton Archive' this material now forms the nucleus of the Subterranea Britannica Collection. The term Holmpton Archive was inappropriate as RAF Holmpton (near Withernsea, east of Hull) was simply a temporary storage place, not the subject of, the material; and the collection is not an archive in a sense acceptable to professional archivists, being largely a collection of photographs taken by John Harris during 1978 – 79 in the course of visiting Cold War sites. None of the material is 'classified' for security purposes. Whilst the core of the material might appropriately be referred to as the John Harris Collection, there is also material collected by James Fox, and it is expected that

we shall add other material in the coming years, as the Subterranea Britannica Collection grows.

There are something like 2,340 colour prints many of them mounted in 20 albums, some corresponding negatives, and 14,000 slides. As received, few or none of these are annotated with location details. Member Bob Jenner is cataloguing the material, and identifying locations by reference to his own large collection of Cold War material, a project estimated to take up to a year. After that it will be necessary for the Society to find a safe place of deposit for the photographs. Discussions with the owners / occupiers of a number of Cold War bunkers are in progress to this end.

Copyright in the photographs has been passed to Subterranea Britannica, and it is expected that they will all be scanned for electronic storage, and posted on our web site.

A selection of the photographs were on view to members at the recent Day Conference at Leicester, where Bob Jenner described the material.

Day Conferences

The Autumn Day Conference at the University of Leicester on 6th October saw a very well received programme of lectures, a film, and a good set of members' 'brief communications.'

Andrew Smith started the day with a description of the new New York City Emergency Management Centre which, oddly some of us thought, is a surface building with no NBC protection but guarded by raised flower-beds!

David Amos drew on his experience in the Nottinghamshire collieries, and in a voluntary capacity in connection with the coalfield's D.H. Lawrence heritage, to present a superbly delivered overview of the mines' history from early times to closures. Along the way, he managed to explain a great deal about mining methods, and the human dimension of the mining communities. David seems sure to have a stream of requests for repeat performances from members in the audience looking to book speakers for other groups' meetings!

Dr. Hillary Shaw, a longstanding member, presented a well-illustrated and masterly overview of the geographical and economic setting of Beijing and its continuing and extraordinarily rapid development, as the context for a discussion of the old Beijing Hutongs (narrow inner-city alleyways) and the enigmatic tunnel system (publicly visitable) below them.

Bill Whitehouse of the Derbyshire Cave Rescue Organisation took us through the realities of searching for and recovering people, suicides, dogs, sheep, murder

weapons, and even a horse from underground places. He managed to treat such an important subject in a compellingly interesting and light-hearted way, without for one moment losing sight of its seriousness. One relatively minor underground accident he described called for 60 volunteers during a period of 11 hours and, of course, effective liaison with ambulance, fire and police services. Bill did not hesitate to remind us that, practiced by properly equipped and experienced persons, going underground is probably safer than travelling by road!

We concluded the formal programme with a viewing of the USA History Channel film 'Secret Underground Cities: London' starring none other than our very own Andrew Smith who kept popping up at places such as the Camden Town Deep Level Shelter, and the Dollis Hill Alternative Cabinet War Rooms! Members found the American style of presentation a trifle comic, which made for a light-hearted end to a splendid day.

Study Weekends in 2008

Preliminary planning is in hand for another French visit (Paris or northern France) perhaps during the weekend of 24 – 26 May; and a weekend in Yorkshire provisionally planned for 5 – 8 September.

Subterranea Britannica's Access to Information Files and a Plea for Newscuttings!

Subterranea Britannica's Chairman, Paul Sowan, has collected printed material relating to subterranean sites, mostly but not exclusively European (including British) since he first bought a holiday postcard at Wookey Hole (Somerset) around about 1949! He is currently a paid-up or honorary member of almost 100 societies, and reads all their magazines. In his capacity as Librarian to the Croydon Natural History & Scientific Society (founded in 1870) he curates a large collection including geological and archaeological books and journals, and sees many more current journals. For years he read two daily newspapers (*The Guardian* and *The Times*) and cut out any items of underground interest, so he has a large collection of newscuttings. He also receives newscuttings, pamphlets, and books and other information from a number of correspondents throughout the UK and the rest of Europe. He maintains an index to all this material, some on library cards, but increasingly stored electronically on the Subterranea Britannica computer in his care. Many of these items are noticed in *Subterranea*, and its predecessor *Newsletter*.

Members are asked to **send in any newscuttings and magazine articles on underground or related topics** to supplement what is already held and indexed. These should be annotated with the complete **name** of the

The Conference was Andrew's triumphant last as Day Conference Organiser, as he is stepping down after 5° years in that capacity, although he will continue to assist with audio-visual equipment. Your Committee have arrangements in hand for keeping up his splendid record.

Hugh Ainsley manned the SB bookstall, with a range of back-issues of our publications on sale, and Mike Moore, of Moore Books, had an impressive bookstall groaning under books on Cold War, mining and other subjects.

The Spring Day Conference (and AGM) for 2008 will be at Imperial College, University of London, at South Kensington on 12th April. Work on the programme is in hand, with lectures already lined up on the Clifton Rocks Railway Tunnel (later WWII BBC studios), and Titan (the huge natural cave recently 'brought to light' in Derbyshire).

newspaper or magazine, **date** of issue, or **volume and part number**, and **page number(s)**, please.

This is not a one-way process. He will do his best to answer enquiries, particularly concerning mines, underground quarries, canal railway and road tunnels, especially in the British Isles and mainland Europe. His own library also contains works on archaeology, civil engineering, applied geology, canals and railways, and military geology.

Paul also has first-hand knowledge of (and local contacts for) many UK sites, Iceland, the Faeroes, the Maastricht area in the Netherlands and adjoining parts of Belgium, several underground quarries in France, and some sites in Croatia, Poland and Ukraine, and numerous other places around Europe.

Thanks to, amongst others, Derek Bayliss (Sheffield), Ron Eteson (Croydon), and Adam Sowan (Reading) for items in this issue of *Subterranea*.

Paul can be contacted on 020-8688-3593 most mornings from 07.00 onwards, or by mail at 1 Chaucer Cottages, 7 Pilgrims' Way, SOUTH CROYDON, Surrey CR2 7HT. He is too busy reading the torrent of printed stuff to have time to dabble in Emails and the web, although he does use the latter at the British Library from time to time.

News-Archaeology

THE WESTERN HEIGHTS / COWGATE CEMETERY 'CHIMNEY', DOVER, KENT

The enigmatic brick 'chimney' emerging from the grassland slope upwards from the (closed) Cowgate Cemetery to the Western Heights fortifications at Dover has long puzzled local historians. It seems more likely to be associated with the cemetery than with the fortifications above, which are not known to have tunnels reaching down this far in this direction. On the other hand, it seems far too early to be an early experimental cremation using (bizarrely) an underground furnace, as the cemetery appears to have closed in the 1850s or 1860s, whereas cremation was not regularised in Britain until the 1870s or 1880s. Peter Harp of Banstead has recently suggested the 'chimney' (if that is what it is, rather than a solid column) was have been built to vent smelly and noxious fumes resulting from the decomposition of corpses, implying some sort of catacomb reached via an entrance in the back wall of the cemetery.

News - Conservation, Heritage & Tourism

DOVER WESTERN HEIGHTS SCHEDULED ANCIENT MONUMENT, KENT

Concern has been expressed at the current condition and lack of maintenance of the Western Heights fortifications (largely 18th – 19th century) overlooking Dover's Western Docks area. The structure, a sculptured, fortified, and tunnelled chalk hill facing that on which Dover Castle stands, has been listed amongst English Heritage's 16 most important 'basket cases' despite its status as a Scheduled Ancient Monument. Public access is allowed, at best, on a few days each year.

SOURCE: Maev KENNEDY, 2007. The stately wrecks of England. *The Guardian*, 25 July 2007, page 9.

FORBIDDEN CORNER, COVERDALE, NEAR LEYBURN, YORKSHIRE

There is an 'amazing labyrinth' of connected follies and underground passages 'dreamed up by a retired diplomat who owns the local moorland estate' at Coverdale, near Leyburn, Yorkshire. A report says 'It is just frightening enough for older pre-teens and the little ones will be OK if you hold their hand tightly' so would evidently suit Subterranea Britannica's more senior members! See www.yorkshirenet.co.uk/theforbiddencorner.

SOURCE: MartinW in 'Things to do' in *The Guardian*, 15 July 2006.

WILLIAMSON'S TUNNELS, LIVERPOOL

The tunnel systems (if systems is an appropriate word for a bizarre and apparently random collection of tunnels and subterranean chambers) at Edge Hill ascribed to the eccentric Joseph Williamson who died in 1841 have known entrances at three sites. That at Paddington is

leased by Liverpool City Council to Prime Living Group, the owners of adjoining student accommodation. Lawyers acting on behalf of the City, the company, and the Friends of Williamson's Tunnels (a company limited by guarantee, incorporated 11 February 1997, company number 3316101, registered charity number 1087822) are reportedly well on their way to arranging a transfer of the lease of the Paddington entrance to the Friends. Planning permission has been obtained for the Friends' plans to establish this as their publicly accessible site. Mains electricity is being laid in to replace the former portable generator. Lighting is being installed underground, and electrically powered conveyors brought in to facilitate removal of quantities of rubble which currently fill many of the voids.

The latest News Update is silent on the state of affairs at the Mason Street and Stables entrances, the latter now being the site of a Joseph Williamson Society interpretation and underground visits centre. Collaboration with the independent Society appears to be improving, a pre-requisite for further progress with the City Council who have expressed a wish to enter into a dialogue with one voluntary body rather than two.

SOURCE: Friends of Williamson's Tunnels, *News Update*, Summer 2007.

News - Defence & Military

RE-EXCAVATION OF A WORLD WAR II AIR-RAID SHELTER AT EDGWARE JUNIOR SCHOOL, LONDON

The accidental uncovering of the edge of a concrete structure in the playing field at Edgware Junior School (TQ 19479151) in Heming Road, Edgware, London, in the summer of 2005 resulted in an archaeological and historical research programme to investigate the thirteen air-raid shelters known to have been provided at the site during the Second World War. A resistivity survey of the field, and subsequent excavation, was supplemented by a study of relevant school and local authority records, and interviews with local residents who had attended the school as children during the war. Much of the work was undertaken by members of the Hendon & District Archaeological Society. The project was incorporated into the school's educational programme, providing a contribution to the pupils' knowledge and understanding of archaeological and historical methodologies, and of the war. It is hoped to be able to retain access to one of the shelters for use as a permanent teaching aid.

The school buildings date from the 1890s, with occasional extensions down to the 1930s. Although the buildings suffered no direct hits during air-raids, damage was caused on two occasions by a bomb and by a V1 rocket landing nearby. The thirteen shelters at the site were built by Lavender, McMillan Ltd., of Worcester Park, and were fitted out as new with electric lighting, wooden

seats, and chemical toilets. Improved lighting, heating, and ventilation were added a year later. After the end of the war, investigations revealed that fixtures and fittings were stripped out and disposed of for scrap, and the main entrances and emergency exits blocked by concrete plugs and / or back-filling.

Resistivity surveys located several of the shelters below the playing field. It was thanks to the memory of a former pupil that others were found to have been built below the asphalt-surfaced playground.

One shelter was excavated and re-entered, and found to lie 0.52 metres below the field surface. It consisted of a room 15 metres long, and contained the remains of a WC cubicle at each end. Entry was by way of a short, straight flight of steps down. A vertical iron ladder at the far end opposite the entrance led to an emergency exit. Although most of the wartime fittings had been removed, there were miscellaneous finds including a fragment of post-medieval green-glazed earthenware and an 1862 halfpenny.

SOURCE: Gabriel MOSHENSKA, 2007. Unearthing an air-raid shelter at Edgware Junior School. *London Archaeologist* 11(9), 237 – 240.

AIR RAID SHELTER IN EAST SHEEN TO BE DEMOLISHED

One of London's few remaining air raid shelters' is set to be demolished following a decision by English Heritage not to list the property at St Leonard's Court East Sheen. Its fate now rests in the hands of a government planning inspector.

The Mortlake and East Sheen society say that "it is the only shelter in the area where the interior is still in such excellent condition. Its demolition would mean the loss of a valuable educational resource".

Richmond council say that it would have been impossible for them to make a decision during the Heritage assessment

SOURCE: Evening Standard 15 November 2007

'GREAT ESCAPE' TUNNELS AT STALAG LUFT III REVEALED, POLAND

Stalag Luft III, a World War II Sonderlager, lay to the south-east of Berlin, at Zagan in what is now western Poland. The site, now forested, was made famous by a number of published books describing prisoner-of-war escapes. Recent archaeological work has revealed evidence relating to the remains of three of the escape tunnels commenced at this site, code-named Tom, Dick, and Harry. Tom was discovered by the Germans in 1943 and destroyed; Dick was discontinued; Harry was completed and used for the 'Great Escape' of 23 – 24 March 1944. The site of hut 122, from which Harry was dug, was located by reference to surviving footings. Excavation revealed the tunnel at a depth of about 10 metres on the west side of the hut. Bed boards, used to



Camouflaged 10.5cm gun

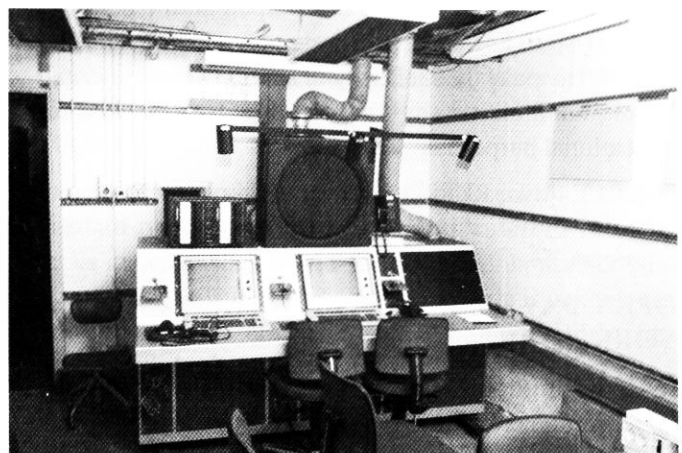
support the sand in which the tunnel was dug, were discovered, as were 'klim' (powdered milk) cans strung together to form a ventilation duct. Various other artefacts are also reported. It is reported that the Stalag Luft III site has considerable archaeological potential, as it is thought that over 100 tunnels were started here. The better-known include tunnel 'George' and the 'Wooden Horse tunnel'.

SOURCE: Norman HAMMOND, 2007, Stalag Luft III's 'Great Escape' tunnels revealed. *The Times*, 8 October 2007, page 58 [Based on a paper 'Multidisciplinary investigations at Stalag Luft III Allied Prisoner-of-War Camp: the site of the 1944 "Great Escape." Zagan, Western Poland' by J.K. Pringle, P. Doyle and L.E. Babits, in *Geoarchaeology* 22, 729 – 746]

WORLDS ONLY 10.5 cm COLD WAR COASTAL ARTILLERY GUN PRESERVED IN SWEDEN

After the 2nd world war Sweden updated its coastal defences with over 40 modern batteries in four different types; two of these at Femöre and Hemsö have been visited recently by Sub Brit members.

Six 10.5 cm guns were manufactured and placed in three batteries in the Stockholm archipelago. This was the first type of gun battery with full protection from nuclear weapons built in Sweden and with the guns able to fire



Operations Room

automatically up to 40 rounds per minute it was even possible to hit airborne targets.

Two of the batteries were demolished in the early 2000's but the remaining battery was placed on the list for preservation by the Swedish National Trust. The Arholma battery was sited on the islands of Arholma and Ovanskär in the northeast part of the Stockholm archipelago, protecting the seaways from Finland. With one gun on each island the guns were self-sufficient with their own command centre, radar, dormitories etc. This made it possible for them both to fire individually or as a pair. The gun and bunker system on Ovanskär was demolished in 2005/2006 but the system on Arholma was handed over to the National Trust during 2007.

Initially the battery had optical measuring equipment combined with radar and later this was replaced by modern radar with digital battle control. All this equipment will be on display at the museum, showing the technical advances made during the battery's 30 year life. The museum is due to open in summer 2008.

Source: Lars Hansson

Web site: www.bunkertours.se/mh/ovanskar.html

Photos by Lars Hanssen

HISTORIC CLASSROOM IN A WORLD WAR II AIR-RAID SHELTER AT SHEFFIELD, SOUTH YORKSHIRE

Sixth form pupils at the King Edward VII School at Broomhill, Sheffield, working in liaison with the Sheffield Wildlife Trust and with £ 10,000 Heritage Lottery Fund support have been investigating a 'labyrinth of reinforced concrete air-raid shelter tunnels' built under the school grounds in 1939. These reportedly include a triage centre for bomb casualties, showers, and an ARP (air-raid precautions) base. The school's pupils and nearby residents would have sheltered here during air-raids. The shelter was not in fact needed for its primary purpose as the school area was not bombed. However, pupils enjoyed lessons underground during practice sessions. A rota of older boys, acting as fire-watchers, slept at the school.

Under the guidance of Rebecca Carpenter, the School's Head of Sixth Form, the group are now seeking a further £ 60,000 to make the shelter more accessible and to install benches and electric lighting to allow it to be used for educational purposes.

SOURCE: Mike RUSSELL, 2006, Shell out to restore our air-raid shelter. Pupils appeal to develop an historic classroom. *Sheffield Star*, 29 September 2006.

OPEN DAY AT RAF FYLINGDALES, NORTH YORKSHIRE

RAF Fylingdales, North Yorkshire, including the underground operations bunker, was opened to the press on 1st August 2007, apparently as a public relations exercise to advance the view that this (and another facility

at Menwith Hill, near Harrogate) is an entirely independent British facility, at which 82 RAF personnel and a single US liaison officer send radar data to the USA Cheyenne Mountain defence centre within 60 seconds of receipt. The emphasis is on detecting potentially threatening incoming missiles, whether from 'super-powers' or 'rogue states' or independent terrorist groups.

SOURCE: Martin WAINWRIGHT, 2007, Britain insists on joint role at 'son of Star Wars' base. *The Guardian*, 2 August 2007, page 15.

LOCAL COMMUNITY BUYS CULTYBRAGGAN RGHQ

The residents of a Perthshire village have become the owners of a former prisoner of war and Army camp and a Regional Seat of Government

The village of Comrie has bought the Cultybraggan camp site from the Ministry of Defence for £350,000.

The 'historic' sale was facilitated by right-to-buy legislation, and was completed on 14th September.

Residents have still to decide what to do with the 90-acre site, which was used to house up to 4,000 prisoners during World War II. Hitler's deputy, Rudolph Hess, was held at Cultybraggan for one night after his plane crash-landed in Scotland.

The camp site includes the Cultybraggan RGHQ which was finished in 1990 and was constructed to replace Anstruther. The Comrie ROC post is also located within the camp.

There was an open day at the camp including tours of the RGHQ on 10th November

SOURCE: BBC News 19 September 2007

US DEVELOPS NEW BUNKER BUSTING BOMB

The US is secretly upgrading special stealth bomber hangars on the British island protectorate of Diego Garcia in the Indian Ocean in preparation for strikes on Iran's nuclear facilities.

The improvement of the B1 Spirit jet infrastructure coincides with an "urgent operational need" request for £44m to fit racks to the long-range aircraft.

That would allow them to carry experimental 15-ton Massive Ordnance Penetrator (MOP) bombs designed to smash underground bunkers buried as much as 200ft beneath the surface through reinforced concrete.

One MOP - known as Big Blu - has already been tested successfully at the US Air Force proving ground at White Sands in New Mexico. Tenders have now gone out for a production model to be ready for use in the next nine months.

The "static tunnel lethality test" on March 14 completely destroyed a mock-up of the kind of underground facility



used to house Iran's nuclear centrifuge arrays at Natanz, about 150 miles from the capital, Tehran.

Although intelligence estimates vary as to when Iran will achieve the know-how for a bomb, the French government recently received a memo from the International Atomic Energy Agency stating that Iran will be ready to run almost 3000 centrifuges in 18 cascades by the end of this month. That is in defiance of a UN ban on uranium enrichment and would be enough to produce a nuclear weapon within a year.

Diego Garcia, part of Britain's Indian Ocean Territory, has several current missions. US Air Force bombers and Awacs surveillance planes operate from its 12,000ft runway and the USAF Space Command has built a satellite tracking station and communications facility.

The Ministry of Defence says the US government would need Britain's permission to use the island for offensive action. It has already been used for strategic strike missions during the 1991 and 2003 Gulf wars against Iraq.

The new Big Blu bomb is 20ft long, weighs 30,000lb and carries 6000lb of high explosives. It is designed to go deeper than even existing nuclear bunker-busting weapons.

The bomb is designed to be dropped from as great a height as possible to achieve maximum velocity and penetrating power, guided on to target by satellite and accurate to within a few feet.

Each B2 bomber would be able to carry only one weapon because of its weight. The B2s, normally based at Barksdale, Missouri, flew round-trip strikes against Baghdad in 2003, but would ideally be positioned closer to its targets for missions against Iran.

The Pentagon has drawn up contingency plans for a range of attacks on Iran. The likeliest is a five-day bombardment, aiming to disable nuclear facilities and all major airbases and radar facilities; the most devastating would involve air and cruise missile attacks on 1000 targets, including headquarters and barracks of the Iranian Republican Guard Corps, over more than a month.

SOURCE: The Herald (Scotland) 31 October 2007

News - Mines & Quarries

ABERPERGWM AND TREFORGAN COAL MINES MAY BE REOPENED, SOUTH WALES

Energybuild, a Welsh mining company, has plans to re-open and develop two collieries closed during the Thatcher era – Aberpergwm and Treforgan. Production is expected to recommence later in 2007. The nearby Tower colliery, on the other hand, is expected to close.

SOURCE: Marianne BARRIAUX, 2007, Miner floats boost for Welsh coal. *The Guardian*, 7 August 2007, page 22.

COAL MINERS TRAPPED UNDERGROUND AT CRANDALL CANYON MINE, UTAH, USA

Six coal miners were trapped 450 metres below ground at the Crandall Canyon mine in Utah. It was predicted that it would take at least three days to bore a 5 cm diameter hole to allow communication with the trapped men, and supply of air, food and water.

SOURCE: ANON, 2007, Slow progress in effort to reach trapped miners. *The Guardian*, 8 August 2007, page 16.

MINE SHAFT COLLAPSES IN NEWCASTLE

Major disruption has been caused to the Tyne and Wear Metro system after an old mine shaft collapsed near a station. A train driver spotted the hole near the track at Northumberland Park, North Tyneside in the evening of 17th October.

All services were suspended on a 2.5 mile (4km) stretch of track between Benton and Shiremoor.

SOURCE: BBC News October 2007

NEW USE FOR ABANDONED JAPANESE COALMINE

In Japan, Sun Microsystems has formed a consortium with 12 other companies and Chuo University. This consortium is planning to lower self-contained computing facilities into a disused coal mine. The goal is to create an underground data centre, Sun claim that this will consume up to 50% less power than an above ground facility.

The coolant will be ground water and the site's temperature is a constant 15 degrees Centigrade all year, meaning no air-conditioning will be needed outside the containers. This reduces the energy required for the water chillers, used with Sun's surface-level Blackbox containers.

The group estimates that up to \$9 million of electricity costs could be saved annually if the centre were to run 30,000 server cores.

The disused coal mine is located in the Chubu region on Japan's Honshu Island. Sun will build 30 Blackbox self-contained data centres containing a total of 10,000 servers (cores). This can be increased to 30,000 cores if there is the demand for it. The containers will be linked to power, water cooling and network lines via external connectors.

Sun has been developing its Blackbox concept for three years; a typical one has 250 servers mounted in seven racks inside a standard 20-foot shipping container. Sun says that With T-series processors, a single Blackbox can hold up to 2,000 cores, providing 8,000 simultaneous processing threads.

A subterranean data centre will be easier to secure against unauthorized entry and terrorist attacks. The Blackbox containers are robust enough to withstand up to magnitude

6.7 earthquakes, Sun claims. The Nihonkai-Chubu earthquake shook the region in 1983.

The project has been initially estimated to cost \$405 million and the site should start offering data centre services to public and private sector customers in April 2010.

SOURCE: Techworld.com 16 November 2007

News - Tunnels & Tunnelling

ALLEGED SECRET SEX LAIR TUNNELS IN CALIFORNIA, USA

'America's 160th richest person' has been accused of planning a 'secret and convenient lair' underneath his California mansion, 'dedicated to drug-taking and sex with prostitutes'. The report includes a photograph of Henry Nicholas 'in one of the tunnels beneath his home' which appears to incorporate a steeply descending narrow flight of steps.

SOURCE: Ed PILKINGTON, 2007, Billionaire denies building secret sex lair. *The Guardian*, 19 July 2007, page 22.

LONDON'S CROSSRAIL TO GO AHEAD

The east-west mainline loading gauge rail line proposed as long ago as 1989 to link the existing main line at Paddington with that east of Liverpool Street seems now to be assured of sufficient funding (estimated at present at £ 16 bn) for work to start. It will pass in tunnel below central London, and provide a strategic high-capacity and high-speed link between London Heathrow, the City, and Docklands. The British Airports Authority, Canada Wharf Group, and City of London Corporation are all to make funds available. Government funds and fares revenue will also help pay for the project, which it is estimated might commence public service in 2017. A Crossrail Bill is currently before Parliament.

The new railway below central London is proposed to have new sub-surface stations at Bond Street, Tottenham Court Road, Farringdon, Liverpool Street and Whitechapel. Trains will serve 74 route miles between Maidenhead and Shenfield.

One part of the line has already been built: a 36 metre ventilation shaft below the Moorhouse office complex. This was built early (before the office block) as construction would have been rendered more difficult and costly once the block had been erected. A photograph of this shaft is published in the published account of which details are given below.

SOURCE: Dan MILMO, 2007, Green light for Crossrail as City stumps up cash. *The Guardian*, 3 October 2007, pages 1 and 26.

SWEDISH TEST SITE FOR STORAGE OF NUCLEAR WASTE

Following Finland, Sweden has started to investigate the possibility of storing its nuclear waste in granite deep below surface. The Äspö Hard Rock Laboratory is sited close to city Oskarhamn on the east coast of Sweden close to one of Sweden's nuclear power stations which has three reactors.

The lower level of the laboratory is almost 500 meters below ground and the road down is 3 km long with a constant gradient of 14%.

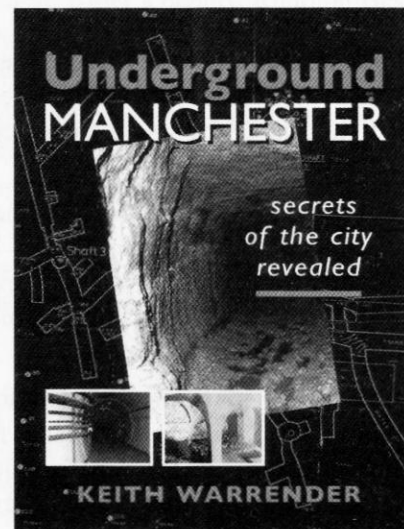
This laboratory allows public tours and some further information can be seen on www.skb.se/templates/SKBPage___8855.aspx (note this is four '_' together)

The web site includes a film in Swedish about the planned deep level storage facility.

Source: Lars Hansson

News - Publications

UNDERGROUND MANCHESTER - SECRETS OF THE CITY REVEALED



By Keith Warrender

Although there is much speculation, few people know what lies below the Manchester streets. This book is the first to cover all things subterranean, past and present, in and around the city and it reveals that there are canals, caverns, a water wheel, passages and even tales of buried treasure.

It begins with two immense Victorian canal engineering projects - the Manchester and Salford Junction Canal tunnel which runs beneath the Granada Studios to the Great Northern entertainment complex, and the 'Dukes Tunnel', near Whitworth Street, built to bring coal from the mines at Worsley right into the heart of Manchester.

Next is Victoria Arches, close to Manchester Cathedral,

used during the last World War as an air raid shelter. This underground space has been the subject of much rumour, and author, Keith Warrender, sets out its history and reveals what is really down there. He describes the time when a well-meaning councillor suggested that the power down there should be supplied by two men pedaling on a tandem with a dynamo.

The story of 'Guardian' the city's nuclear bunker is unfolded, and there is coverage of the unseen features beneath many city landmarks. For example three tunnels, with evidence of coal mining activity, were discovered beneath Victoria Station; a deep shaft beneath a cafe which once stood on the Arndale Centre site; and a department store which recreated a Venetian waterway in its basement, complete with gondolas and the Bridge of Sighs.

The aspect which really captures people's imagination and curiosity are the accounts of underground routes, seemingly not known about by the Council. Yet the amazing eye-witness stories brought together in this book indicate there is much more, down below, than we ever thought. Evidence is presented for tunnel a network beneath several of the main thoroughfares as well as routes which stretch way beyond the city boundaries. Many of the city centre pubs also have stories of tunnels which cannot be ignored.

As Manchester has been redeveloped, there have been some amazing discoveries such as a cavern complex near Ardwick Green, a huge underground reservoir near the Mancunian Way, and a vast network of tunnels beneath the old MIST site at Sackville Street.

There is coverage of a tunnel to Higher Broughton and its possible link with the 'Pilgrimage' tunnel to Kersal Cell; descriptions of what lay below Ancoats Hall; and chapters on the man with the mysterious connections who seemed to know more about underground Manchester than anyone else. There is a vivid description of a wild creature confronted by one sewer worker, and also a trip to see the workings of the now closed Bradford colliery.

Published November 2007. ISBN 978-0-946361-41-0 Available from all major booksellers and stockists or direct from the Publisher, Willow Publishing, 36 Moss Lane, Timperley, Altrincham, Cheshire, WA15 6SZ. £15.95 + £2.50 p & p

CHANNEL TUNNEL

The first publications issued by the Oakwood Press, established by Roger Wakeley Kidner [1914 – 2007] and [Richard] Michael Robbins [1915 – 2002] in 1936 were very slender histories of specific railways. Since then, they have been superseded by substantial books, including a weighty volume on the very short Waterloo & City line. Although rather longer than the Waterloo & City's tunnels, the Channel Tunnel (in fact of course three tunnels side by side) is the subject of a somewhat smaller but still very substantial tome of 256 pages.

Nicholas Comfort's book deals, amongst other things, with the history of the Channel Tunnel, its construction, operation, and signalling; its problems including an under-sea fire and the asylum seekers issue; and the (short) British and (lengthy) mainland European high speed connecting lines. Of particular interest, perhaps, is the chapter describing in some detail the making of the tunnels, and management of access, materials supply, and spoil extraction.

There is generous provision of colour photographs, and a substantial index.

DETAILS: Nicholas COMFORT, 2006, *The Channel Tunnel and its high speed links*. Usk: Oakwood Press: 256pp + folded map £ 19.95 [ISBN 0-85361-644-2]

HISTORICAL WALKS IN THE KENT COALFIELD

A new booklet describes historical aspects of the Kent coalfield in east Kent, including detailed route plans. Information is provided on what remains, or no longer remains, of the four former productive mines - Betteshanger, Chislet, Snowdown, and Tilmanstone, (and of three of the failed collieries - Maydensole, Stonehall (Lydden), and Guilford (Waldershare.) Other aspects of the underground of east Kent noticed briefly are the Tilmanstone colliery's ropeway tunnels through the cliff at Dover Eastern Docks, and the Ash RAF radar station. Also the former East Kent Railway including its short half-excavated tunnel near Shepherdswell.

DETAILS: Paul HADAWAY, 2007, *The miner's way trail*. Dover: Dover District Council: 106pp + 19pp maps booklet in pocket [ISBN 0-9517577-2-5]

NENTHEAD LEAD / ZINC / SILVER MINES, CUMBRIA

The Northern Pennines Heritage Trust, a registered charity and limited company, was established in 1987 and, as a result of a number of successful applications for grant aid, operates an impressive site at Nenthead claimed to be (at an altitude of 1,500 feet) the highest village in England. The mines and buildings seen today date from the period 1745 – 1965, and are set in one of the earliest purpose-built industrial villages in the UK.

The site is at NY 7545 on the A689 road some four kilometres east of Alston, and three kilometres short of the County Durham border. There is a well-appointed visitor centre and refreshment room, and a well-stocked bookshop with numerous titles of interest to mining archaeologists and historians. On an extensive surface site there are impressive remains of the various buildings and processing plant, supplemented by reconstructions of (for example) a water-powered installation for ore preparation. One such building contains the Brewery Shaft, which is lit from top to bottom. There is a standard underground tour in Carr's Level (1815), and the possibility, for those groups suitably equipped,

experienced, and dressed, and making arrangements in advance, for a more extended and adventurous visit underground in the nearby Smalleugh Mine.

The very readable guidebook explains the history and technology of the mines, smelt mill (1737), refining building (1792) for extracting silver from the lead, barracks, assay house (1833 / 1855), dressing floors and crushing mills, and other surface features. A compressor plant was installed and operated from the late 19th century by the Belgian Vieille Montagne Zinc Company.

Further information is available from the Nenthead Mines, Nenthead, Alston, Cumbria CA9 3PD (Emails: admininstration.office@virgin.net / website <http://www.npht.com>)

Another five kilometres to the east, in County Durham, is the Killhope mine site at NY 8243 operated by Durham County Council. This, too, is exceptionally well-presented, with important surface structures and reconstructed plant. The underground visit at Killhope is substantially within a fibreglass replica mine which, nonetheless, is skilfully done and presents quite realistically (wellington boots are supplied as paddling through water is called for) a number of key features of north Pennines lead mines within a small area (inside a well-disguised concrete box!)

REFERENCE: Northern Pennines Heritage Trust, nd, *Nenthead Mines guide book* Northern Pennines Heritage Trust: 16pp.

QUARRY RAILWAYS

Ian Peaty's new book, subtitled somewhat misleadingly *A history of quarry railways* deals in fact only with the railways associated with quarries which, by way of a series of mergers, ultimately fell under the control of Hanson Aggregates. However, this does include important concerns in Cornwall, Devon (Dartmoor), Dorset (Portland), Gloucestershire (the Forest of Dean), Kent (the Medway area), Leicestershire (Charnwood Forest), Somerset (the Bath stone quarries and the Mendip Hills), and North and South Wales.

Of especial interest to Subterranea Britannica members will be details of railways at some of the underground Bath stone quarries, such as Corsham.

DETAILS: Ian P. Peaty, 2006, *Moving mountains by rail: a history of quarry railways*. Stroud: Tempus Publishing Ltd: 192pp [ISBN 0-7524-3861-1] [PWS]

THE SECRET HISTORY OF CHEMICAL WARFARE IN THE UK

Another book by Nick McCamley, *Secret history of chemical warfare*, is of particular interest in that it contains details of the manufacturing and storage site at Rhydymwyn (Valley Works) in North Wales. This is of added interest as, additionally to the poison gas manufacturing and storage functions, this site also hosted

'Tube Alloys', a cover name for the secret work undertaken in connection with the UK's World War II atomic weapons work, specifically the isolation of uranium 235 from uranium 238 by the gaseous diffusion method using uranium hexafluoride. Chapter 8 is devoted to '*Storage and disposal of Second World War chemical weapons*',

The book is available for £ 19.99 + postage and packing from Mike Moore at Moore Books – website www.moorebooks.co.uk email: mike@moorebooks.co.uk DETAILS: N.J. McCAMLEY, 2006, *The secret history of chemical warfare*. Barnsley: Pen & Sword Books Ltd: xv + 188pp [ISBN 1-84415-341-X]

WORLD WAR I EXPLOSIVES / MUNITIONS MAGAZINES

'During the First World War the storage of high explosives and propellants such as TNT and cordite and their distribution to ammunition factories became a huge and complex undertaking. The available storage accommodation attached to Woolwich Arsenal was normally sufficient for War Office requirements, but in 1915 the need to substantially increase production of gun ammunition following the 'shell scandal' and the creation of the Ministry of Munitions, required a corresponding increase in the storage capacity for explosives and propellants in additional magazines. At first a number of quarries, mines, caves and disused forts were utilised by the Explosives Storage Section of the Department of Explosives Supply, but this measure soon proved inadequate with the introduction of American imports.'

Thus commences a recently published article on the First World War Slimbridge Magazine, which includes a map of such sites in England and Wales as at September 1916.

Halstead (one of the 1890s North Downs French invasion mobilisation centres near Knockholt, Kent) is shown, as are Reigate and Godstone (east Surrey) where storage of cordite and nitrocellulose is indicated. Oddly, cordite and nitrocellulose storage is also indicated at Crowhurst, although the location of this store indicated on the map suggests that this may be an error for Chislehurst. Godstone has several large underground quarry / hearthstone mine systems; Reigate has silver-sand mines accessed via doorways in the walls of the 1824 road tunnel in that town; and Chislehurst 'Caves' (actually a large chalk mine complex) are a well-known tourist attraction.

SOURCE: Brian EDWARDS, 2005, Slimbridge Magazine. *Archive* 45, 52 – 63.

ROMAN MINING ON THE MENDIP HILLS, SOMERSET

A new monograph describes surface excavation and fieldwork on an area of Roman lead and ironstone mining at Charterhouse-on-Mendip, on Somerset. Finds of pottery, coins, and animal bones are reported from stratified deposits in ditches and mining rakes or trenches (the excavated topmost parts of veins worked for galena

(lead) and haematite (iron).) A supposed 'fort' is interpreted as a works depot. Indications of possible pre- and post-Roman mining, some of the latter from underground mines, are briefly noted. The first century Mendip mining field is related to the wider Roman landscape and economy.

DETAILS: Malcolm Todd, 2007, *Roman mining in Somerset: Charterhouse-on-Mendip: excavations 1993 – 5*. Exeter: The Mint Press: x + 88pp [ISBN 978-1-903356-51-7] £ 10.

Late News - New investment at South Crofty Tin Mine

Progress towards commercial tin production at the South Crofty tin mine in Cornwall will be accelerated following the formation of a new mining company on 2nd November 2007.

Western United Mines Limited is a newly formed company which will own and operate the South Crofty tin mine. Baseresult Holdings Ltd, which bought South Crofty in 2001, is the majority shareholder in Western United Mines Ltd alongside Cassiterite LP, an investment vehicle that is acting for, amongst others, Galena Asset Management Ltd., a subsidiary of global commodity trader Trafigura Beheer.

The move, which formally took effect on Friday 2nd November 2007, will boost the economy of the Camborne, Pool, Redruth area of Cornwall which suffered when South Crofty, the county's last working tin mine, closed in 1998. With new investment, management expertise and experience at board level, the work to resume tin production over the next two years will play a key role in local regeneration.

In excess of £3.5 million will be spent by June 2008 on continuing the mine development. Tunnelling and exploration drilling activities begun by Baseresult earlier this year will continue with this injection of fresh capital bringing the total investment by that date to £9 million. The further £50 million of investment required by the time the mine starts production, which is projected for the end of 2009, has been earmarked. Staffing levels have already increased from 17 to 26 and, by July 2008, that figure is expected to have risen to 35 full-time employees.

Local businesses have already been benefiting from the renewed activity at South Crofty. Orders worth more than £300,000 have been placed locally – including one for a drilling machine that is being built by a Camborne firm, Drillserv Ltd. That figure is set to increase as more equipment is purchased over the next few months.

Christopher Hall, an experienced mining finance and investment specialist, is the independent non-executive chairman of the Western United Mines board. Currently mining adviser to Grant Thornton LLP, Mr Hall's 30 year career has spanned mine geology, mining share analysis,

specialist fund management, mergers and acquisitions, establishment and management of an AIM listed mining finance company and wide-ranging consultancy.

Christopher Hall said: "I am delighted to renew my association with South Crofty after some 20 years. The mine always suffered from a shortage of investment in exploration in the past. The vision of Baseresult, the financial strength and market expertise of its new partner Galena, and the undeveloped potential of the South Crofty tin deposits look like a winning combination. I look forward to helping to guide the project back into production for the benefit of the shareholders, the workforce and the Cornish economy."

Kevin Williams, Managing Director of Mine Operations added: "When we bought South Crofty in 2001 we made our commitment to redeveloping it as a working tin mine very clear. Experience tells us that we should be able to resume full tin production and that there is potential for a mining life of eighty years. The tin price has moved ahead strongly since the purchase and we are delighted that we pressed ahead with our plans. Today's events effectively underwrite the mine's funding for the future. We have the expertise, we have the passion and now we have added the financial strength of our new partner to the picture. This should be seen as a great day – not just for Cornwall but also for UK industry."

South Crofty closed in 1998 when the tin price was less than a third of the current level. New uses for tin, particularly in lead-free solder, will keep prices buoyant for many years to come and make an investment in tin mining a very attractive proposition. The experience of the management and the support for mining from the local community have been key in our decision to make a long term commitment to this project.

Source: Press release from South Crofty Mine



New Cooks Kitchen Shaft – Photo by Nick Catford

Geneva Excursion

Keith Ward and Nick Catford

Another grand plan was hatched after finding two excellent websites for the Fort Association of St. Maurice in the canton of Valais in the Swiss Alps. Three forts, Scex, Cindey and Champex are all open for public visits and after an exchange of e-mails our two day excursion was arranged for 28/29th September 2007. These days flights to Switzerland are very affordable and we were able to take advantage of Easyjet's £53 return flight to Geneva with eight members of Subterranea Britannica travelling from Stansted on a very mild and sunny morning which was a pleasant surprise as heavy rain had been forecast.

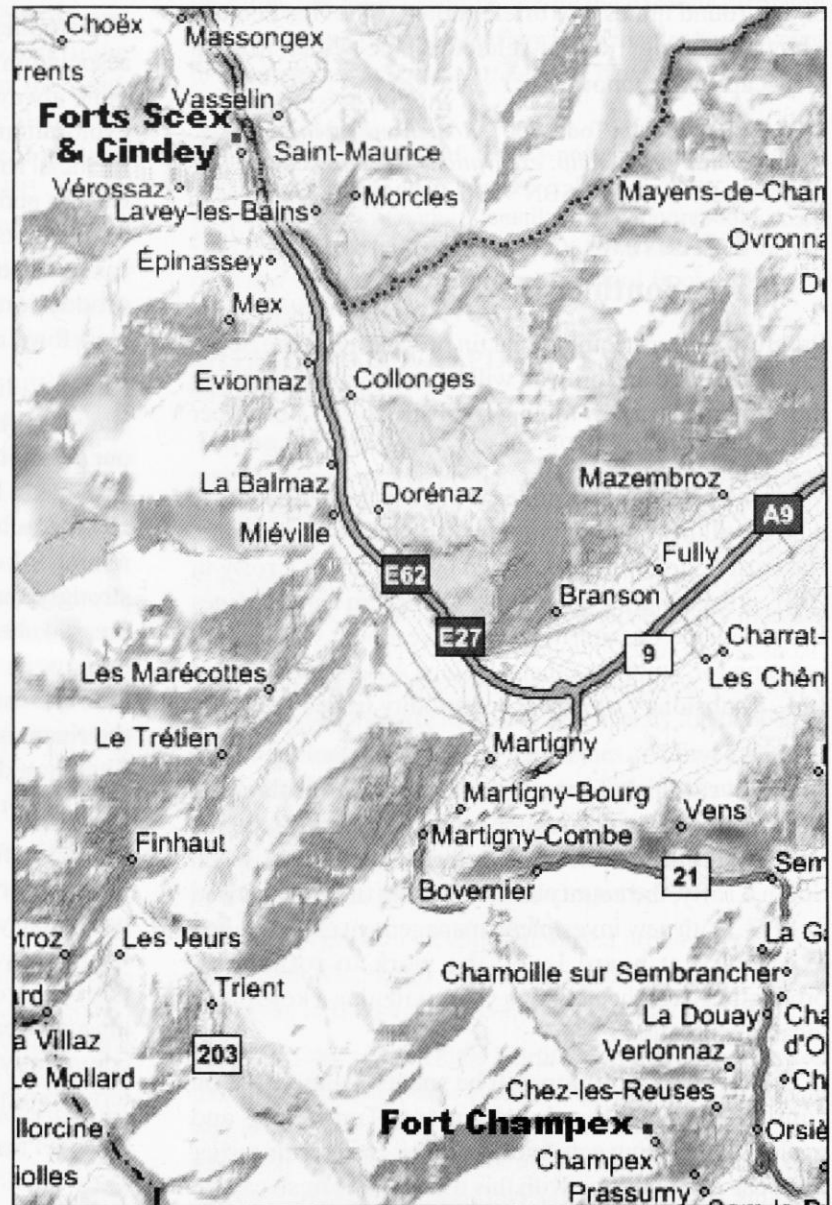
From the airport it was a two hour drive in our hire cars along the north side of Lake Geneva to Fort Champex near Martigny; the last part of our journey up a twisting mountain road to the picturesque tourist village of Champex.

FORT CHAMPEX

Fort Champex is at an altitude of 1450 metres and is part of the defences of the Fortress Grand Sainte-Bernard with 57 fortifications including three artillery forts defending the Sainte Bernard pass route from Italy and 15 infantry shelters in the mountains. The fort was built between 1940-1943 but was modernised and adapted during the cold war and wasn't vacated by the Swiss army until 1988. The fort is entirely underground with 600 metres of galleries serving four casemates divided into two batteries. One battery is equipped with 10.5cm guns with a range of 18.5 km and the other with 7.5cm guns. The 10.5cm guns were last fired in 1986. The fort had a garrison of 150 men but this could be doubled to 300 in times of tension.

On arrival at 15.00 our pre-arranged English speaking guide didn't turn up so our trip was delayed as frantic phone calls were made to try to find a replacement. The keys for the fort are held at the nearby hotel so we retired there for coffee and awaited an alternative guide who eventually arrived at 17.00. None of our party spoke much French and our new guide spoke no English but despite this language barrier he was very helpful and Bob Clary spoke enough French to understand the gist of what he was telling us.

Fort Champex is an artillery fort with the designation A46 and is entered by a typical camouflaged Swiss Fort



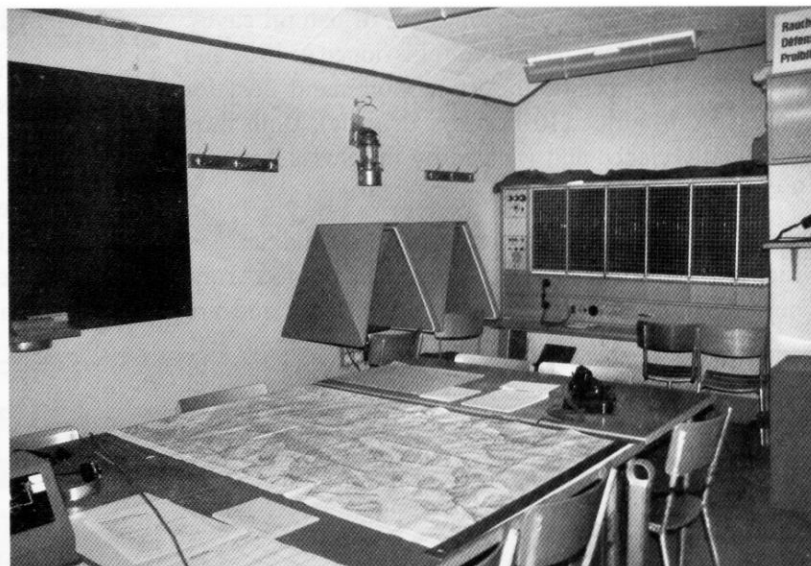
entrance with fibreglass painted to look like a natural rock face, beyond this there are two conventional steel blast doors protected by a machine gun post.

On entering the fort there is a small guard post and telephone exchange on the right after which the main corridor turns to the right with rooms on either side. The first room on the left is the Air Conditioning Plant Room with NBC filters and through a door at the back of this room are the two diesel generators. The remaining rooms on the left hand side are, in order, the Operating Theatre, Officers' Dormitory, Main Mess and Other Ranks (OR) Dormitory. On the right the rooms contain showers and toilets, OR Dormitory, Officers' Mess, kitchen and a further OR Dormitory.

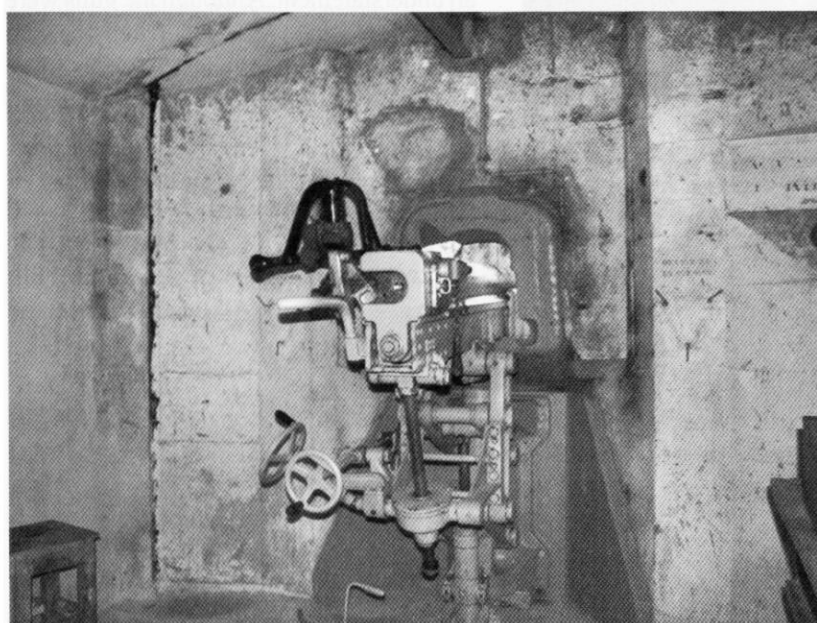
Beyond these rooms a short corridor to the left leads to the Fort Commander's Office and the Command Post for

the first and second batteries. A second corridor on the left leads to the offices for the Chiefs of Staff and the artillery Command Post. Each fort has a group Command Post which is in charge of a group of guns. In addition, Fort Champex is the Command Centre for the entire Sainte Bernard Defences, linked to all the batteries and forts as the Central Fire Command Post. The fort is still fully equipped with a central radio base, telephones and telephone switchboard. All the operational areas are accessed through further blast doors off the main tunnel.

At the end of the main corridor there is a further blast door and then a junction, straight ahead leads to a pillbox for a 7.5mm



Artillery Command Post



7.5cm gun

machine gun. The 10.5cm battery is to the left with access from the tunnel to two Observation Posts and after a further blast door the first of two ammunition magazines for this battery. Beyond the magazine are the two 10.5cm artillery casemates side by side with their guns still in good order. Beyond the second casemate a short corridor leads to an emergency exit. Between the two casemates a dog-legged tunnel leads through a further blast door to the second identical magazine and beyond this a further passage leads through a final blast door to a second emergency exit which is protected by a machine gun position.

The 7.5cm battery is to the right, at the end of the main access corridor. We were unable to see this as the area was closed for 'safety' reasons.

After our visit to Fort Champex we drove to St. Maurice where we stayed in the Hotel du Midi which had been recommended by Pascal our guide for the following day. Pascal was waiting outside the hotel sharp at 8a.m. for our visit to Forts Scex and Cindey. Like many men in Switzerland, Pascal is a part-time soldier serving as a Colonel in the Swiss Army. His English was excellent and his enthusiasm for the forts was quickly apparent describing Fort Scex as the best fort in the world (after the tour, he may be right).

There is a steep climb up the one common entrance to both forts hidden behind a cafe complex. All plant and munitions for the two forts were taken by cableways which are still fully functioning.

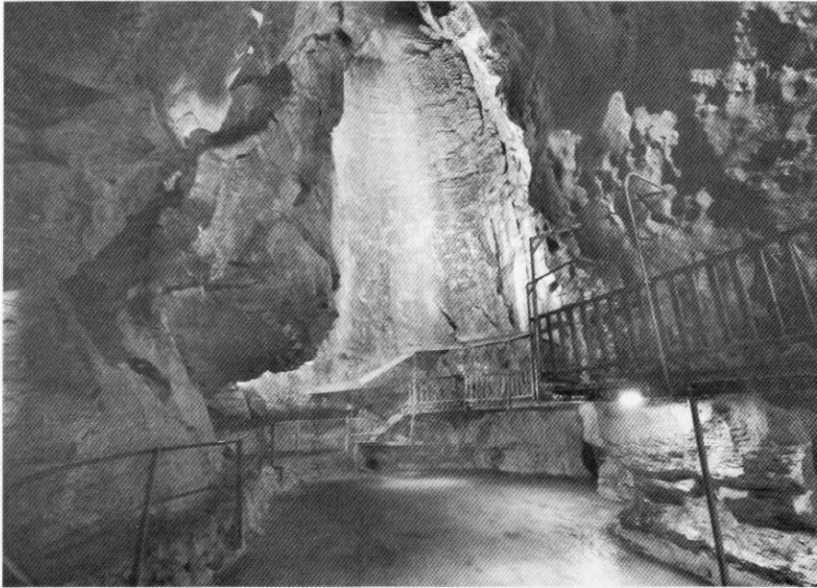
THE FORTIFICATIONS OF ST. MAURICE

St. Maurice is the northern end of the principal Alpine transit route between the Franche-Compté region of France and the Piedmont region of Italy. This determined the military importance of the area and the constant interest in erecting fortifications there. The first fortress at St. Maurice was built in 1831 but with the advances in munitions this soon became obsolete and had to be replaced. In 1892 construction began of Forts Savatan and Dailly on the right bank of the River Rhone. It was soon necessary to protect these two forts with flanking guns. Initially guns were emplaced on the terrace on the opposite bank of the river but in 1911 Fort Scex was built and armed with four 7.5cm guns.

The fort was enlarged between 1915 – 1924 and in 1935/6 a new connecting gallery was driven to link the fort

with the 'Grotte aux Fées', a system of natural caves. The guns at Fort Scex were decommissioned in 1952 and the installation became the Main Command Post for Fortress St. Maurice (10 Fortress Brigade). Both forts were finally closed and vacated by the Swiss Army in 1995.

On the other side of valley are Forts Dailly and Savatan which are retained on care and maintenance by the Army. They are both still used on 'practice days' and are



Waterfall in the Grotte aux Fées

scheduled to close in about 8 years. Savatan has an underground inclined railway and both forts are highly automated, there being a big 25cm gun turret. We definitely want to visit this fort when possible and as the forts are on the Unesco Protected Site List their future seems secure. Unlike Sweden, where decommissioned forts are generally stripped of all fixtures and fittings, including wooden door frames, the Swiss Army tend to hand them intact to local associations for preservation which is a very enlightened approach helped by the enthusiasm of local people for their country's heritage.

After entering through the Grotte aux Fées, we soon reached the tunnel leading to Fort Cindey, which we were going to see later in the day. We carried on for a good half mile through the winding cave passage which ended at a spectacular underground waterfall. We retraced our steps for a short distance to the locked steel door giving access Fort Scex and separating it from the public cave system.

FORT SCEX

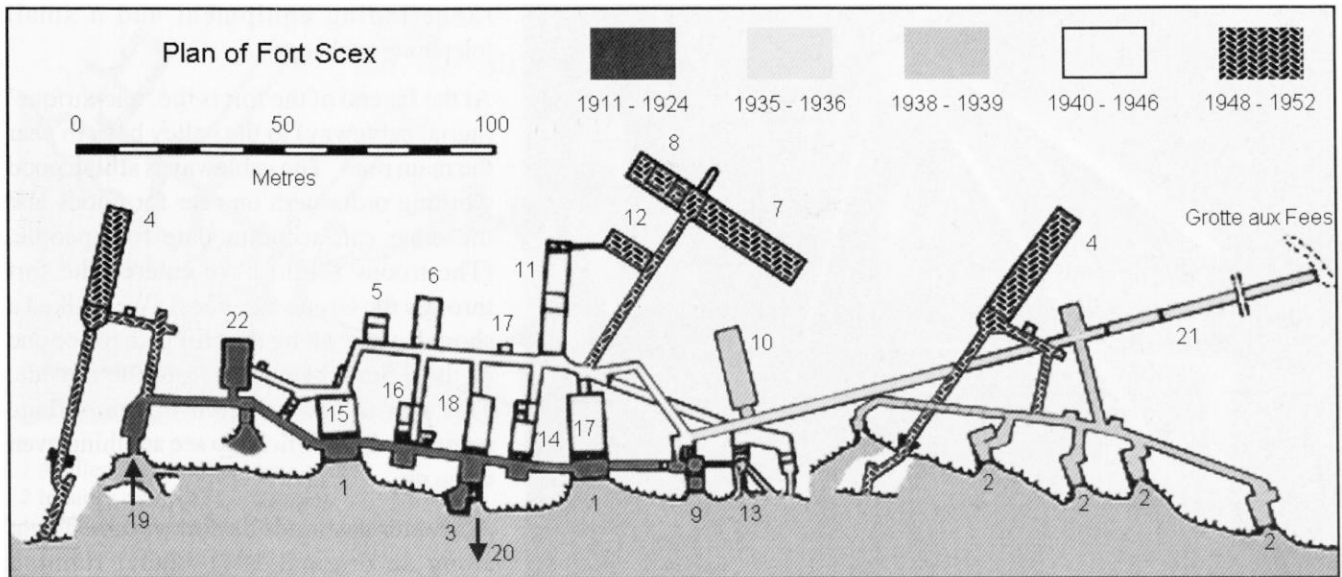
Having unlocked the door the door the natural cave continues steeply upwards with a flight of slippery steps cut into the rock floor. We eventually reached the fort which is at the far end of a 480 metres long unlined man made tunnel which was driven between 1935-1936 to link the fort to the Grotte aux Fées. Half way along this tunnel a turn to the left leads to a battery of four 7.5cm casemated guns and an observation post which were added to the fort between 1938-1939. Near the end of the long tunnel, a short side tunnel to the right gives access to a ladder up to a reservoir for the two forts which still holds 330,000 litres of water. We finally entered the 1911 fort along a doglegged passage and through a steel blast door.

To say Fort Scex is impressive would be an understatement. Although the guns were decommissioned in 1952 when the site became an HQ Command Post, one of the 7.5cm guns is in still place. Although completed in 1911 the fort has undergone a number of changes over the years with several additional tunnels being driven and the layout has been radically altered. The fort was completely stripped and rebuilt internally between 1940-1946 when the artillery casemates were shortened to form

a number of new rooms behind. These were linked by a new main access tunnel which was driven behind the casemates linking the new rooms with the now isolated casemates. Having entered the main corridor our first call was a tunnel to our left that leads to the main air intake with its large fan. We retraced our steps and then

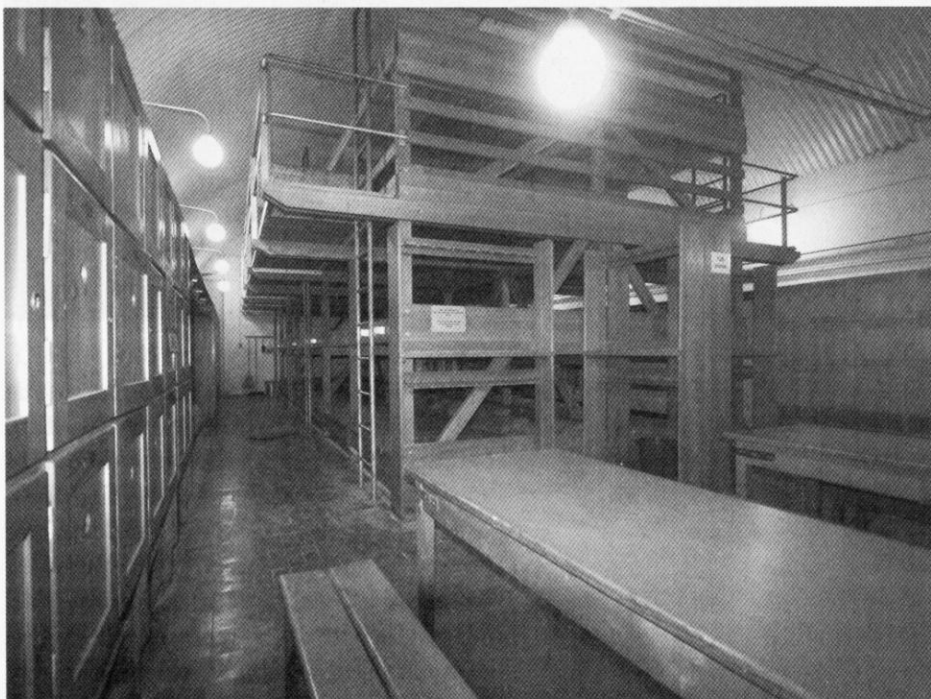


Telephone Exchange at Fort Scex



- 1 Artillery casemate for two 7.5cm guns
- 2 Artillery casemate for one 7.5cm gun
- 3 Caponier for 4 fortress machine guns
- 4 Ammunition magazine
- 5 Battalion Fire Control Centre
- 6 Officer's Quarters
- 7 Command Post
- 8 Telephone Exchange
- 9 Radio Station
- 10 Water reservoir (330,000 litres)
- 11 Plant Room

- 12 Fuel Tanks (4 x 12,000 litres)
- 13 Air intake
- 14 Kitchen
- 15 Other Ranks Mess on two floors
- 16 Officers' Mess on two floors
- 17 Dormitory
- 18 Lavatories
- 19 Aerial cableway
- 20 Emergency exit
- 21 Connecting gallery to the 'Grotte aux Fées'



'Other Ranks' Dormitory

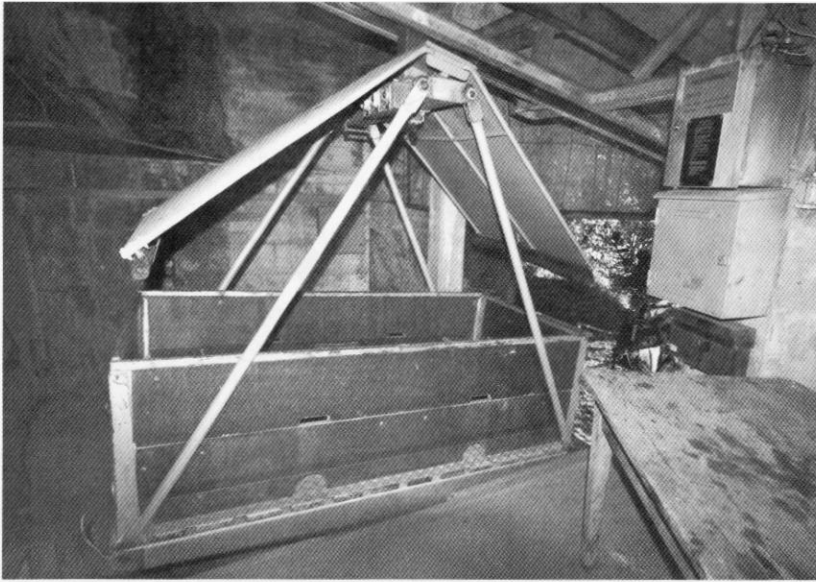
turned right along a post war tunnel that took us to the telephone exchange and Command Post.

The telephone exchange is divided into several rooms, one with a bank of manual switchboards and another containing the main distribution frame. The Command Post still has a number of maps on the walls which show

the disposition of troops and defences in area. The 201st and 204th Infantry Brigades defended the St. Maurice and Martigny area. Key points to be guarded included the District Civil Defence Command Post under Martigny fire station, which coordinated all defences in the area with radio and telephone links. Each Infantry Brigade had Platoons positioned to defend the main pass through the valley and each Platoon HQ was able to communicate with the Command Post by field telephone. Official Designation was HQ 10 Defence Area St. Maurice Fortress.

From the exchange we returned to the main corridor to look at

the impressive 'Other Ranks' Dormitory which is located in one of the rooms created by shortening one of the original 1911 casemates. The room contains a massive three deck block of timber bunks in the centre of the room, with two lines of bunks end on to each other on all three levels. There are wooden lockers along the two side walls and tables and benches at one end of the room. In the



Top station for the aerial cableway

range-finding equipment and a small telephone exchange.

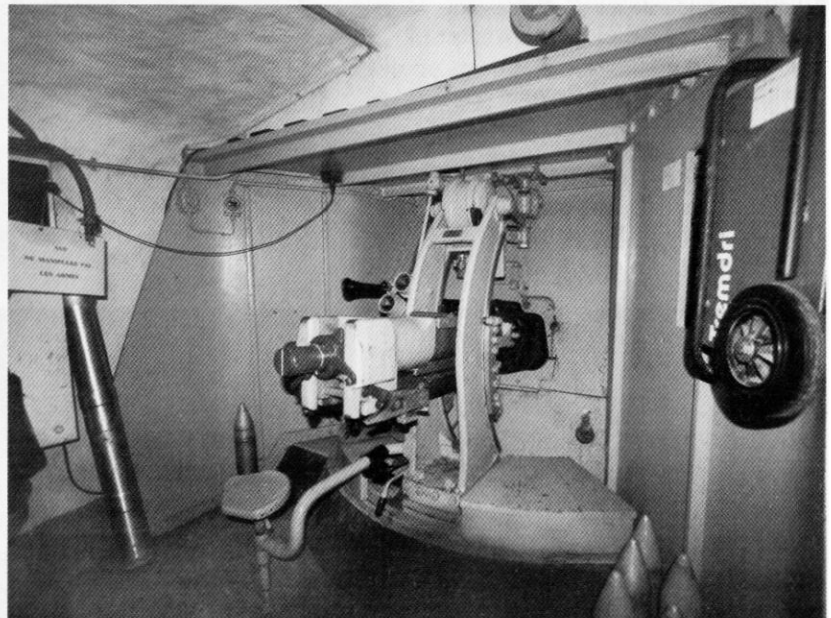
At the far end of the fort is the 'telephrique' (aerial cableway) to the valley bottom near the main road. The cableway is still in good working order with one car for goods and the other can accommodate four people. (The troops would have entered the fort through the Grotte aux Fées). We walked a short distance along the cliff path to see one of the 7.5cm casemates from the outside. This gun is now covered in camouflage netting and it's difficult to see anything even close up.

After returning inside the fort we turned right along an original 1911 tunnel running

past, visiting groups have been allowed to sleep in this room.

Opposite the dormitory we saw the plant area which is divided into two rooms one containing the air conditioning plant, complete with NBC filters and the other the three diesel generators which also supply back up power to Fort Cindey.

Next to the dormitory there is a well equipped kitchen with timber work surfaces and furniture and two store rooms, once containing crockery, cutlery and cooking utensils. Next to the plant rooms the smaller Officers' Quarters are complete with single bunks, tables, chairs and lockers. Alongside the Officers' Quarters is the Battalion Fire Control Centre complete with its



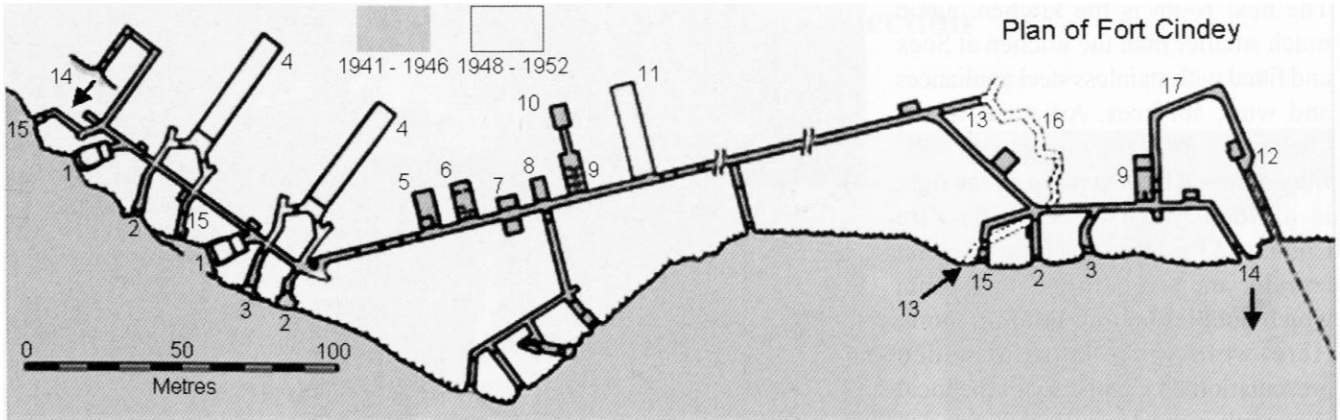
10.5cm gun at Fort Cindey



Operating Theatre in Fort Cindey

through the front of the casemates. The 7.5cm gun is still in place in the first casemate; it is still in good working order and blank rounds are occasionally fired from it. Beyond the casemate there is a caponier protruding out from the cliff face where four fortress machine guns gave flanking fire. Pascal mounted a weapon and demonstrated its controls for us. Above the caponier is an observation post with 3 slits. The caponier was for self defence of the fort rather than defence of the surrounding area.

As time was pressing (Pascal had another tour in the afternoon) we quickly retraced our steps back through the fort followed by the long slog through the Grotte aux Fées to a steel door at the entrance to Fort Cindey



- 1 Artillery casemate for 10cm gun
- 2 Infantry casemate for 9cm gun
- 3 Infantry casemate for fortress machine gun
- 4 Ammunition magazine
- 5 Battery fire control centre and food magazine
- 6 Dining-rooms and command post
- 7 Filter room
- 8 Kitchen
- 9 Dormitories

- 10 Water reservoir (90,000 litres)
- 11 Infirmary
- 12 Aerial cableway
- 13 Entrance to the 'Grotte aux Fées'
- 14 Emergency exit
- 15 Observation post
- 16 'Grotte aux Fées'
- 17 Ammunition monorail

which was reached at the top of a flight of steps. The two forts are 1 km apart.

FORT CINDEY

Construction of Fort Cindey was started during the WW2, being built between 1941 and 1946 to block access to St. Maurice from the north, and defend the anti-tank obstacles formed by the Rhone Canal and the 'Le Courset' River, as well as concrete blocks placed on the roads and railway lines. The fort was re-armed between 1948-52 with two 10.5cm guns. Other armaments included four 9cm anti-tank guns and three fortress machine guns. The garrison consisted of 1 Fortress Company with 173 men.

Although the fort was modernised post war for Cold War use there have been few structural changes apart from the addition of an infirmary wing and two 10.5cm casemates and two ammunition magazines which were added between 1948 – 1952.

Having entered the fort we first looked at the infirmary wing which is divided into a number of rooms including



Fire Control Post in Fort Cindey

a consulting room and a fully equipped theatre for minor operations. There was also a store room with portable medical packs. The OR Dormitory was next to the infirmary wing. It wasn't as impressive as its counterpart at Fort Scex consisting of 16 standard twin metal bunks with wooden lockers at the end of the room. As with all forts, there are always far fewer bunks than there are personnel with a 'hot bed' system in operation. A typical day might consist of eight hours in bed, eight hours recreation and eight hours on duty. Once a bed is vacated the next person would use it.

The next room is the kitchen, again much smaller than the kitchen at Scex and fitted with stainless steel appliances and work surfaces. Adjacent to the kitchen is a small filter room with NBC filter drums. The next room on the right is divided into two with the Fire Command Post fronting onto the main corridor and behind it the mess room which doubles up as a briefing room. Here we were given a short video presentation on the history of the local forts with mouth watering footage of Fort Savatan across the valley with its 25cm guns and automated ammunition loading machinery. The Fire Command Post was perhaps one of the most impressive rooms in the fort with its



St Maurice Civil Defence HQ

digital telephone exchange; one of most modern to be found in any Swiss fort. We also saw the apparatus for determining the location of the target and the bearing and elevation the guns required to hit it; this had been Pascal's job in earlier times and he spent some time explaining exactly how this complex manual rangefinder and charts were used to plot the firing of the guns.

The main battery for the fort is located at the far end of the main corridor and consists of two 10.5cm casemated guns, two 9cm anti-tank guns, one fortress machine gun position and two observation posts with two ammunition magazines located behind the casemates. All the guns are in good order and we had a chance to play with one of the 10.5cm guns and a number of our party took great delight in looking through the gun-sight and playing with the gun's control.

By now our time was running out, we had already been underground for nearly five hours but before leaving the fort we went back beyond the entrance where there is another infantry casemate with a 9cm anti-tank gun. Here we saw an unusual ammunition guideway that links the main corridor with the aerial cableway station. This consists of an inclined tunnel with a platform mounted on a single monorail at side of tunnel. We emerged back into daylight at 13.40hrs having gone underground at 08.45hrs!

We must thank Pascal for our extended tour as we saw many areas that the normal tour doesn't visit. We were originally scheduled to start at 10.00 but Pascal had suggested an earlier start so that we could get more in. After the tour he said we were the most enthusiastic group he had taken round and for our part it was a delight to taken round by a true enthusiast.

After a nice lunch in the cafe adjoining the entrance we reluctantly made our way down the steep path to our cars below. Adjoining the main road below and cut into cliffs were three entrances with blast doors, these were the Civil Defence HQ for the Commune of St. Maurice incorporating a control centre and public shelter for those in older buildings in the town without their own air raid shelters. Although the blast doors were all open there were internal locked grilles so these tunnels will have to wait for another visit.

We had a quick look at the bottom station for Fort Cindey cableway but we didn't have time to visit the Scex base station. On the way back to the airport we drove over to the other side of the Rhone valley to see an impressive twin barricade of dragon's teeth anti-tank blocks that cross the valley floor. Then it was a pleasant drive to Geneva for the 18.50 plane to Gatwick.

These two forts are probably the most easily accessible in the country as they are only a 20 minute walk from St. Maurice railway station. There are three trains an hour to Geneva airport from the station. The scenery in the area is stunning as one would expect in the gateway to the Sainte Bernard pass.

We look forward to a visit in the future to Fort Savatan when it ceases being operational.

It is a possibility there will be a return visit to Scex and Cindey in 2008. All forts ask for a minimum of 10 persons in order to make a visit cost effective.

Sources: Fort Champex web site <http://www.profort.ch/>

Fortress Historique de St. Maurice web site http://www.forteresse-st-maurice.ch/anglais/fhome_e.htm

Both web sites are duplicated in English.

Acquiring The Sub Brit Collection

Andrew Smith

For many years, John Harris, James Fox and others built up a major research collection on the many cold war sites in the UK. This collection included a large number of photographs, copies of PRO documents, maps and site plans; a true lifetimes work. In mid 2007 the research collection which was housed at the former RAF Holmpton (near Hull) was offered for sale.

A discussion was held between three members of Sub Brit and a decision to view the archive and potentially make a bid to purchase it was taken. A 'consortium' headed up by Andrew Smith, Nick Catford and Bob Jenner made a general appeal to members for funds with the aim of purchasing the 11 filing cabinets full of material and donating it to Sub Brit.

At 5.30am one Thursday morning, Nick, Andrew and Bob set off for Holmpton in order to view the archive. We had no idea what we would find but it turned out to be a veritable goldmine of photographs and documents. A substantial amount of money had been raised and the consortium entered its bid - then we waited!

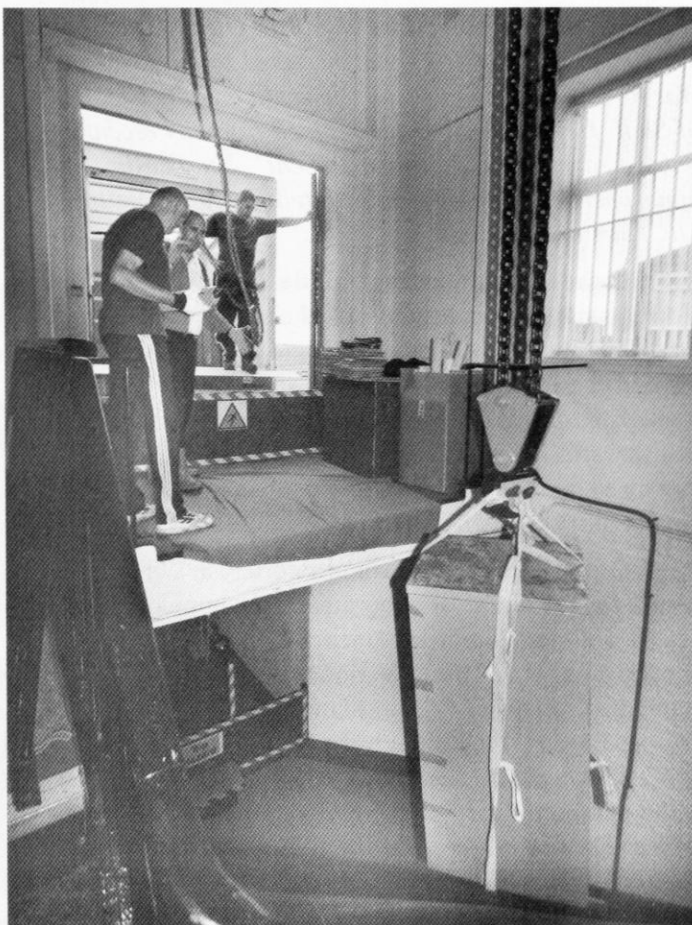
Two days later, on the Saturday, I received a phone call informing me that the bid had been successful and that the consortium was now the proud owner of the archive. Plans were made, a van was rented and the following week Nick Catford, Roy Kenneth and I set off for Holmpton to collect the filing cabinets stuffed full of the collection.

The filing cabinets were located on the upper level of the bunker and had been moved up the access tunnel to the stairwell the night before. Having opened the loading bay doors and positioned the two ton van with the tail-lift as far into the upper stairwell as possible, the task of extracting the archive began.

Each cabinet had to be strapped up and attached to the stairwell hoist, then raised to the upper level and tracked across to the loading bay doors. Once here, the hoist was 'fed out' and the cabinet pushed and pulled through free air to get it onto the tail-lift. Once in position the straps were undone and the cabinet dragged into the van. This had to be repeated 10 times and took 10 to 12 minutes for each cabinet. By the time we got to the last cabinet we were getting quite proficient at the manual handling!!

We then set off for Horsham which is to be the temporary home for the collection whilst it is catalogued. 5 hours later we arrived and unloaded the filing cabinets into their temporary new home.

Then the task of finding out exactly what was in every file and identifying every photograph began. Bob Jenner



James Fox hoists one of the filing cabinets up the stairwell at RAF Holmpton while Andrew Smith and Roy Kenneth wait to haul it into the van. Photo by Nick Catford

has agreed to volunteer for this task and duly set about methodically working through each filing cabinet, starting with the photographs. James Fox at RAF Holmpton and John Harris have helped with identifying much of the material which was completely uncatalogued and the collection is now being put into order. The contents are truly amazing; from photographs of a pristine Barton Quarry bunker to plans of cold war dispersal airfields and it really is a unique collection of material. Some of the photographs depict sites that have long since been demolished providing even greater value.

The material is being scanned and will be placed on the Sub Brit web site in due course but with literally thousands of documents to sort through, the cataloguing will take until Christmas 2008, if not longer. All the material will ultimately be made available to all members via the web site and the collection itself will be relocated to one of the cold war bunker museums.

One thing is for certain, this is a truly unique snapshot of cold war history.

Underground Intelligence

The Joint Intelligence Committee in the Cabinet War Rooms bunker

James Allason

Colonel Allason served as the War Office's senior military planner in 1945, partly based in the Cabinet War Rooms where he briefed Churchill and the Chiefs-of-Staff. Here, in an extract adapted from his recently published memoirs, 'Ringside Seat', he recalls the atmosphere in which the Joint Intelligence Committee (JIC) met underground.

Rain lashed my face as I made my way across Horseguards Parade, heading for the secret heart of the war effort. It was February 1945 and plans for victory were at the forefront of my mind. Ahead, just visible through the downpour marched a squat figure in a sodden British warm. Despite his slow progress under an umbrella that owed more to the Civil Service than to the Army, I did not hurry to catch this officer up.

Denis Capel-Dunn enjoyed some notoriety in Whitehall, famed for his abuse of subordinates, manipulation of equals, and ingratiating of superiors, particularly those of ministerial rank. His reputation had spread among the gentlemen's clubs of St James's for a different reason. 'Young Bloody' they had christened him in Brooks's, where he occupied the unchallenged position of club bore. Although the military planning department of the War Office was one of the Joint Intelligence Committee's principal clients I was in no hurry to establish more than a nodding acquaintance with the spider at the centre of its very tangled web.

Approaching the anonymous sandbagged entrance, I fished my pass from the pocket of a riding mac off which

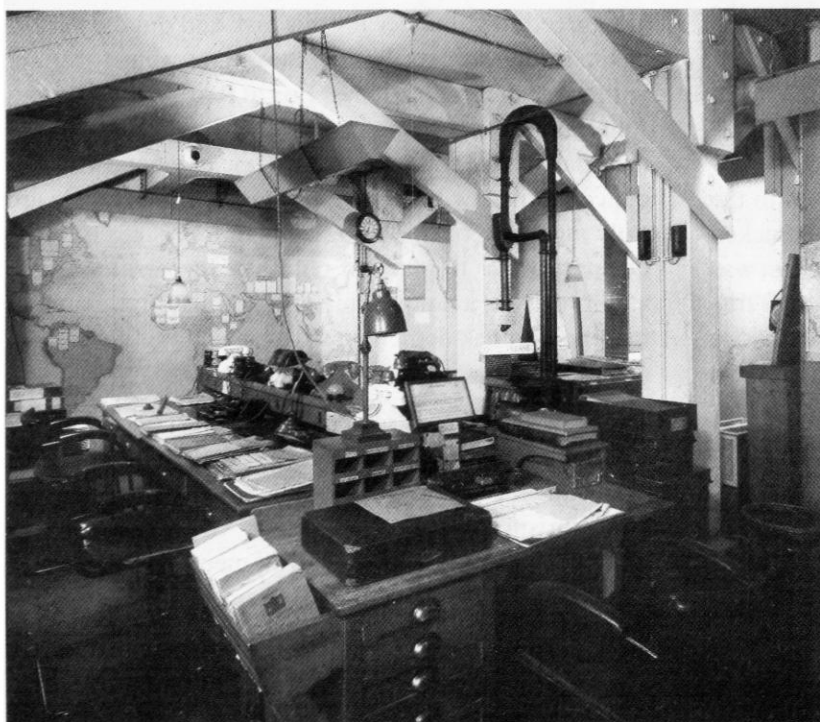


James Allason

water now streamed. The Royal Marine Colour Sergeant at the portal saluted with as much enthusiasm as could be considered reasonable in the circumstances. By the time I had exchanged a word in the cramped lobby with my naval opposite number, Captain 'Ruggy' MacIntosh, Colonel Capel-Dunn had vanished into his subterranean lair like the Demon King.

The Cabinet War Rooms, which I so frequently attended in these uncertain days to give briefings, participate in meetings and amend plans, occupied the fortified basement of the steel-framed Office of Works building in Storey's Gate opposite St James's Park, the strongest structure in Whitehall. Known simply as 'George Street' or 'Storey's Gate', it was protected by a raft of concrete several feet thick strengthened with tram rails and had been designed to resist a direct hit, an engineering calculation fortunately never put to the test.

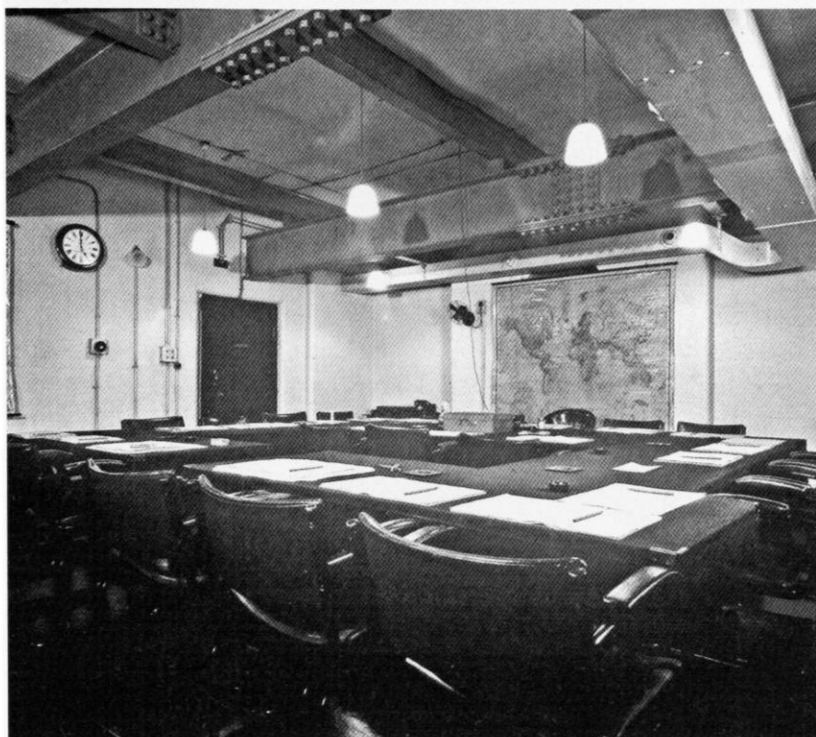
Work had started in June 1938, the War Room becoming operational on 27 August 1939, just a week before the declaration of war following the German invasion of Poland. Well below ground, it was designed to house and sleep a permanent staff of 270, with additional offices for regular visitors such as my own team – and the JIC – in some hundred and fifty rooms. A sub-basement with low ceilings housed cramped dormitories crammed with bunk beds. The complex was huge, with six acres of floor space and a mile of corridors, but only



Cabinet War Rooms

chemical lavatories. While hardly comfortable the atmosphere was purposeful; few of the visitors escorted in by the Marine guards were left in any doubt that this was the hub of the war effort and centre of decision-making.

Within, the bunker was permanently lit, making it impossible to tell whether it was day or night when you looked at your watch. Churchill's bedroom was not close enough to our office to hear him snoring, so the best test was to see whether what we had prepared made any sense when typed up the next day. That composed at 4 p.m. was notably better than the 4 a.m. version. The Premier's sleeping habits were in any event an unreliable guide, as he was as likely to take an afternoon siesta as he was to



Cabinet War Room - The Cabinet Room

keep the Chiefs-of-Staff up most of the night, often with us in attendance. (More frequently, though, he worked and slept immediately above us in the six first-floor rooms of the Number 10 Annexe, the windows barred with steel shutters during bombing alerts.)

Unlocking my briefcase in our spartan room I reflected upon 'Need to Know'. As a young subaltern in India in 1937 I had trained my mounted troops to charge into battle, knowing only that war was coming. Later, commanding a squadron of tanks against the Japanese my knowledge of the enemy's disposition had been less than adequate. By the time I joined Mountbatten as senior military planner to the Supreme Allied Commander South East Asia full information had become a working necessity. Today in the Cabinet War Rooms, although afforded oversight of all military intelligence, I was surrounded by, yet largely ignorant of a further element -

the political dimension. Not so the JIC and its energetic secretary, Capel-Dunn, whose tentacles appeared to reach into every nexus of power and whose ambitions seemed to know no bounds.

Appearances can mislead, however. For, although this was known only to a few, Capel-Dunn had in October of the previous year mounted an invasion of his own. His attempt at a takeover of MI5 had, however, proved an intrigue too far, easily parried by the Director of the Security Service and his éminence grise, Guy Liddell, Director of Counter-Espionage. Thereafter the influence of the Joint Intelligence Committee had been constrained by a closing of secret ranks intended to keep Young Bloody in his box. It seemed that there were confidences to which even the co-ordinator of secrets was not privy. And one of them was under his very nose.

Periodically the Prime Minister would disappear into his private lavatory in the bunker, which otherwise remained securely locked. And there he would remain for a considerable time, giving rise among the secretaries to a tender concern about his insides. It remained a closed secret that behind the door, with its 'Occupied/Vacant' sign, the PM was talking over an encrypted transatlantic radio link to the President of the United States. An early computer, located in an annexe basement of Selfridges department store in Oxford Street, was required to scramble speech securely on this, the first 'hot line'. The highly classified system was codenamed SIGSALY, the London terminal being X-RAY.

With my own papers now organised to give the briefing I proceeded to the figurative centre of the George Street complex, the Cabinet Room. Inside it a square had been formed of trestle tables covered in baize, with a narrow gap to allow members of the secretariat into the centre to take notes. Around the outside, facing in, sat members of the War Cabinet and Chiefs-of-Staff. Whatever the hour a meeting was likely to be in progress in the Cabinet Room. From it issued a stream of demands for information, some of which it was our task as planners to answer; others washed into the JIC.

From a spare meeting room at the far, Whitehall end of the building the JIC had managed to migrate westward, ever closer the focus of power. For as its secretary well knew, access is all. Not just to people but to information and intent. For the secret heart of the bunker was not the Cabinet Room, but the Map Room.

It was, I reflected, no coincidence that the Map Room should be located next to the Prime Minister's bedroom.

From the Map Room he had broadcast to the nation during the dark days of 1940, and I well knew that he still met heads of state and military leaders within its closely guarded confines. The walls were covered with large-scale maps of Britain, the Atlantic and Far Eastern theatres of war, bearing notes of force deployments and convoys. Outside it was posted a list of those granted access. (It is still there today, bearing Capel-Dunn's name and my own.)

An essential component of planning is access to the best intelligence, and my principal source of processed intelligence was Capel-Dunn's boss, Bill Cavendish-Bentinck, immensely successful as Chairman of the Joint Intelligence Committee who doubled as Foreign Office Adviser to the Director of Plans. I did not know that he was of ambassadorial rank (soon to be appointed British Ambassador in Warsaw), and always found him very helpful and never stuffy. This was unusual among diplomats of the period.

Bill had succeeded Ralph Stevenson as Chairman at the JIC and had the personality to co-ordinate all Britain's intelligence activities. It was an immense task, but one he fulfilled with rare skill and a tact not always displayed by the Secretary. Bill was admired by all the directors of intelligence, perhaps with the exception of Admiral John Godfrey at the Admiralty, who had - rightly - suspected that Cavendish-Bentinck was arranging his removal from his post because he was un-cooperative and disruptive.

Godfrey was transferred to the Indian Navy, minus the anticipated knighthood.

As for Capel-Dunn he and I remained contractually bound together yet distant until the cessation of hostilities. As I climbed the bunker steps for the last time that day in August 1945, breathing in a lungful of fresh warm air, he remained somewhere in the bowels beneath preparing his next intrigue. It proved to be the post-war review of intelligence in which more than a few scores were settled, the report being published for classified circulation under his name. Instead of the springboard to the political career and peerage projected by the novelist Anthony Powell in his portrayal of him as the villainous Widmerpool in 'A Dance to the Music of Time' it became Capel-Dunn's epitaph. Having survived the war without hearing a shot fired in anger he died in an air crash later that year, returning from the San Francisco Conference that established the United Nations.

'Ringside Seat - the Wartime and Political Memoirs of James Allason' is published by Timewell Press at £20. It is available to readers at the special price of £15 post free (UK & Europe). Cheques payable to the Blackthorn Group, PO Box 41, Wallingford OX10 6TD.

The Cabinet War Rooms and Churchill Museum, Clive Steps, King Charles Street, London SW1A 2AQ are open daily from 9.30am to 6pm (last admission 5pm) <http://cwr.iwm.org.uk>

From The Archives

A WORLD WAR I DUGOUT

The following description of a First World War dugout in the trenches in Belgium or France was written early in 1915 by a Mr. J.G.N. Best ..

You may like to have more of an idea of what our dug-outs are like, as they form our home for a quarter of our time. The new ones we are having built in our trench have wooden floors and sides, with corrugated iron roofs, on which sand-bags (or rather canvas bags filled with mud and clay) are packed closely round the edges, with mould [soil] dug from the front of the parapet to fill up the centre. This makes it proof against shell splinters and shrapnel (I am glad to say our trenches have not been shelled so far.) The size of our dug-outs is about 6 feet by 6 feet 6 inches, and 4 feet high. The we improve on them ourselves, by putting up shelves (for accommodating our eatables), bracket for candle, etc., etc. On this we have to accommodate three men and one on guard, so that when we snug in together we are quite

comfy and warm. At night, unless there is a very bright moon, we have listening patrols out, i.e., two men who go out in front of the trench, who listen and watch very carefully to prevent any surprise attacks. (We happen to be in a particularly quiet part of the line, and have not had anything in the nature of an attack since our regiment took over the trench.) We are turned out an hour before sunrise to "stand to", during which hot pea soup and rum are served out. The day is spent in bailing and keeping the trench "respectable", and making little improvements of our own, and then in sleeping, reading, cooking, and eating, so at present you see we are not having such a bad time. At the end of our three days, as soon as the relieving company comes up, we file out and march back to "town" for our three days' recuperation.'

SOURCE: H.E. BOISSEAU, 1938, *The Prudential staff and the Great War*. London: Prudential Assurance Company Ltd: viii + 168pp [Pages 25 - 26]

Sub Brit in Cumbria – it's Mine, all Mine!

Martin Dixon

Subterranea Britannica's annual UK study weekend was held in and around Cumbria in early September. To contrast with the military sites visited in Berlin earlier in the year, it was decided to focus on the rich history of mining in the region. Finding accommodation proved tricky as Cumbria has quite a few upmarket hotels and numerous hostels and bunkhouses but not a lot in-between. Eventually and with some trepidation we settled on renting a number of lodges at Center Parcs in Penrith – ideally placed and very economical especially for most who shared rooms.



Honistor Incline - picture Nick Catford

The weather as we assembled on Friday was as perfect as I've ever seen it in the Lakes and most of the group made it to Ian Tyler's unbelievably comprehensive mining museum in Keswick. Ian whet our appetites by describing the great variety of materials mined in the area over the years – over 20 different metals, rocks and minerals! We learnt that graphite was originally used to line cannonball moulds rather than for pencils and at one time was worth more than gold. Barytes (Barium Sulphate) was also mined here and the description of a Barium meal (in like a milk shake and out like a 24 piece crockery set) had us all grimacing. Ian's favourite mineral is Gypsum (of which more anon) as it is used to 'Burtonise' beer and hence provide a clearer pint. As well as



The group outside Kimberley Slate Mine, Honister - picture Martin Dixon

having an extensive collection, the museum is also noteworthy for having a 'hands on' approach so we were all able to handle the minerals and exhibits.

We then made tracks across to Penrith, meeting up with the full group for the rest of the weekend. Joep Orbons won the furthest travelled prize as he had flown in from the Netherlands for the weekend. On the plus side, Center Parcs surprised us with draft real ale – our lodges were also convenient for an after hours chat and drink. Less convenient was Center Parcs 'car-free' policy across the

site which at least kept us all fit; fortunately the weather remained dry for the duration. It also enabled us to see more wildlife including red squirrels and the occasional badger.

Saturday dawned with perfect weather and we loaded up the coach we'd hired for the weekend. Luckily it wasn't full length as Tim (our driver) had agreed to take it over the narrow Honister Pass. The approach up Borrowdale gave us close up views of the local Herdwick sheep, also known as Borrowdale Greybacks. Our first visit was to the Honister Slate Mine – the only slate mine still working in England as a result of its purchase and recent re-opening by Mark Weir. This continues a mining tradition that is documented back to the 1700s and probably started in the Roman period. You can judge how successful the venture has

been by the fact that Mark was picking up his second helicopter on the day we visited.

We took a Land Rover trip up to the Kimberley mine, with fantastic views across the valley of the Yew Tree mine which closed in 1963. Once inside the mine we followed old railway tracks to eventually reach a huge chamber which followed the dip of the slate beds. We could hear drilling in progress on a lower level and made our way down to this using an internal incline. A cable hauled truck complete with turntable dating from 1926 has recently been restored and paralleled our route. Once at the site of the drilling we could see the work in progress to extract the latest batch of slate. Eventually we re-traced our steps and made our way back to the dressing sheds and tea shop.



Haig Pit Headframe - picture Nick Catford

After lunch we continued our journey over the Honister Pass with magnificent views over Buttermere and Crummock Water (as an aside, there is only one lake in the lake district - Bassenthwaite - all the rest are meres and waters!). Our afternoon destination was Whitehaven – site of both the first undersea coal mine in the world and more poignantly of the last deep coal mine in Cumbria. The winding house and headgear of the latter, Haig Pit, have been preserved as monuments and as a museum of Cumbrian coal-mining. As is usually the case

with deep workings, the mine is now flooded and there is no underground access. The museum more than compensated for this, with lots of artefacts and exhibits including details of the all-too-frequent disasters of the 20th century. Some of the victims were never recovered so the pithead stands as an epitaph to their fate. The highlight of the museum is a pair of rare Bever Dorling steam engines built in Bradford. One of these (the man hauler) has been restored and we were able to see it in operation - albeit on compressed air rather than live steam.



Smallcleugh Ore Chute - picture Nick Catford

After the visit inside, we enjoyed the brilliant weather and were able to walk over the cliffs to Whitehaven Harbour – built to export coal. En route we passed the site of the King Pit shaft which by 1793 had reached 960 feet, the deepest in the world at the time. Nearer to the harbour is the remaining ‘candlestick’ (ventilation) chimney of William Pit. This was the site of Cumbria’s worst mining disaster when 136 miners were killed by an explosion and subsequent fire in 1910. A short walk in the other direction took us to the remaining buildings of Saltom Pit which had the first undersea workings and was sunk in 1729. The weather was magnificent and we could see as far as the Isle of Man – about 30 miles distant.

We arrived back at Center Parcs in good time for a joint meal where everyone was accommodated on a single large table which worked well. After dinner we had a fascinating presentation from John Crompton, past President of the North of England Institute of Mining Engineers. John was also a founder



Exiting from Smallcleugh Mine - picture Joep Orbons

Director of the NPHT who rescued Nenthead and entertained us with slides of many of the sites we were visiting and others besides, including some pictures of recent deep level coal mining in Yorkshire. We took over the Cinema for the evening which had first rate seating and was conveniently next to the bar.

As Sunday dawned we could see the North Pennines were under low cloud into which we slowly ascended via the scenic Hartside Pass (1904 feet) to Alston, England's highest Market Town. We had attempted to include Ayle Pit, near Alston, on the weekend's itinerary but sadly this small-scale drift coal mine closed a couple of years ago. It features on the SubBrit website and some members may remember Fred Dibnah operating a 'windy pick' there on one of his industrial archaeology series. We finally arrived at

Nenthead – England's highest village; somewhat ironic that we were climbing so high in order to go underground! A warm welcome awaited us at Nenthead and Peter Wilkinson gave us a history of mining in the area at breakneck speed. This included the unrolling of a plan which would probably have been large enough to wallpaper our spare bedroom. The mines in the area were owned by a number of different companies throughout their life and mined for lead, zinc and silver.

Introduction over, we walked up through the substantial surface buildings that still remain. Some have been converted for re-use as (for example) bunkhouses. One of the large crushing plants no longer has a building – we learnt that the stone was sold and now forms the café we passed earlier in the day at the summit of the Hartside

Pass. Hopefully the remaining buildings are now listed. En route we took a look at Brewery Shaft (300 feet deep) which still has the water pipes installed in the early 1900s to drive compressors and electric generators at the shaft bottom.

At the end of the run of buildings we split into two groups. Half of us followed Peter into Carr's level for a dry walking tour. The rest were led by Sheila Barker into Smallcleugh Mine which involved a wetter entrance and a small amount of crawling. Both sites had rail tracks, fine stone arching, ore shoots and in-situ minerals. Smallcleugh in addition had the remains of an underground horse gin and some preserved hoof-prints, presumably almost a century old. The groups emerged and rejoined for a



Birkshead Gypsum Mine - boring rig - picture Joep Orbons

fine soup and sandwich lunch provided by the Nenthead group.

After lunch we drove the few miles over the pass (2056 feet) into the county of Durham and to Killhope. The history and geology of mining at Killhope is almost identical to Nenthead but the site is now owned and run by Durham County Council. The most obvious feature on the site is the 30 foot diameter waterwheel which was first erected in 1878 by Blakett Beaumont and restored between 1985 and 1988. Overall the buildings at Killhope are better preserved than at Nenthead and most of the water driven plant can be operated. Again we split into two groups but as anticipated the underground aspect was a bit of a disappointment after the morning's trip. The original mine entrance is used but parts of the interior

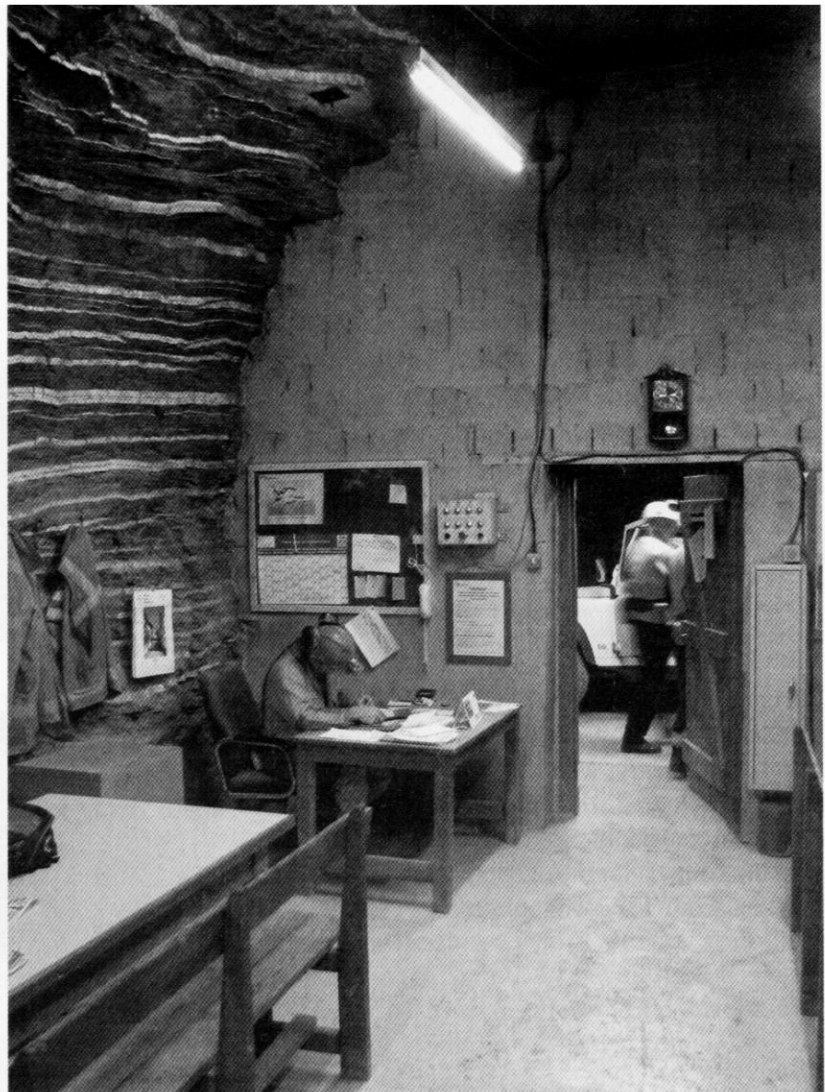
have been remodelled in glass fibre within a concrete box. It does however introduce thousands of school children in particular to underground history and boasts a reconstructed underground water-wheel and some authentic graffiti.

Our Monday visit was limited to 14 only by the mine operators so sadly only part of the group was able to participate. We ventured a few miles down the A66 to Kirkby Thore and there were hosted to a superb visit by British Gypsum down Birkshead mine. This, our second working mine of the weekend, was on an altogether different scale. After kitting up in protective gear including self rescuers, we took to the back of two Land Rovers and started the drift descent to over 1,000 feet deep. The gypsum mined is in interleaved bands of satin spar and selenite and averages about 72% pure. The alternating white and black bands are extremely attractive and presumably formed as a result of local conditions when the evaporate beds were laid down in the Permian era.

About 800 tonnes of gypsum are mined each day and transported via conveyor to the nearby plasterboard works. Gypsum is also used in plaster, to fine beer and in small quantities to set fractures ('Plaster of Paris', named after the former gypsum mines in Paris). Our tour took us through the extraction process from start to finish. First we watched the drilling of holes for explosive charges. Essentially a triangle of holes is made, ranged round a centrally drawn T shape. The central portion has holes drilled that point inwards in order to ensure a wedge of gypsum is blown out on firing.

We next saw explosive charges being inserted and wired. The sequence of the blast is determined by detonators which have a built in delay which varies by drill hole position. The detonators are followed by boosters and then by the main charge of ANFO (Ammonium Nitrate Fuel Oil). The whole cocktail is then sealed by a clay cap. Luckily we weren't in the district when the charges were fired! We moved a short distance to see a face that had been 'prepared earlier' and saw a huge loader with a 7 tonne capacity moving the blasted gypsum. All junction roofs are rock bolted and we watched this work in progress too.

After this we moved into the Knockmoor district and saw a truly mammoth machine mechanically scaling (removing loose material and generally tidying up the passages).



Birkshead Gypsum Mine - District Office
- picture Joep Orbons

Bought from BTI (Breaker Technology Inc) of Canada, this was a real boy's toy. Previously this work was done with a humble crow bar so the increase in efficiency is huge. We also took a trip to the sump at the lowest point of the mine and looked at the two massive water pumps, neither of which was in use at the time. On our way back to the surface we looked at the conveyor system and underground crusher (virtually all plant is underground to reduce the impact on the surface scenery and pollution). Finally we popped into the district office and 'bait' (lunch) room just to complete the picture. All in all a fascinating visit and we were indebted to Peter Richardson and Terence ('Trout') Davidson for their time and guidance.

So, after four days and six sites we'd at least scraped (beneath) the surface of what Cumbria has to offer. We'd looked at about six other sites as possible so maybe we'll return for a future weekend. For 2008, however, we're already looking across the Pennines at a long weekend in Yorkshire including some well preserved cold war sites. See you there!

A Visit To Chislehurst Caves

Philip Lindhurst

On Sunday 20th May, 2007 a group of about 25 Subterranea Britannica members visited Chislehurst Caves in Kent. Our guide, Rod Le Gear, gave a very interesting history of the caves from the early years to the present day, while leading us around the caves.

The caves are a labyrinth of dark and mysterious passageways dug by hand from the chalk deep near Chislehurst station.

Although there is said to be some 20 miles of caverns and passageways dug over a period of some 8000 years, the earliest caves are only 18th century and extend to only four miles. The caves are divided into 3 main sections referred to as "Saxon", "Druid" and "Roman" and each section was later connected by digging out joining passages.

The last time the caves were worked was around 1866 near the bottom of the 90 foot shaft. The earliest recorded reference to the chalk mining at Chislehurst was in a Saxon charter which mentions lime burning – but there is no mention of underground working.

From around 1903 tours were run with concerts taking place but the outbreak of the First World War brought this to an abrupt end and the caves were taken over by the government and they became an high explosive store for picric acid, a TNT depot and became part of the Woolwich Arsenal

A narrow gauge railway was installed with a battery driven electric locomotive taking the ammunition to the "Saxon" or outer part of the caves.

Between the wars, the caves were bought by Kent Mushrooms Ltd. and a part of the mines was used for the cultivation of mushrooms. The high humidity and the constant temperature made them an ideal place. Today the modern production methods make those caves obsolete. The caves are still owned by Kent Mushrooms Ltd., the present owner's father grew mushrooms here in the 1930s.

During World War II, the caves became famous as Britain's largest public air raid shelter, housing a maximum of 15,000 people. Buses left Deptford for the caves at teatime and returned the next morning. The people slept in bunks along the sides of the passages but a few lucky souls were able to make a private area with a curtain. The caves had electric lighting, chemical toilets, a cinema, a chapel, a barber, a gymnasium, and even a dance floor! The caves were so popular, between autumn 1940 and spring 1941 up to 8,000 people slept here every night; the Red Cross had a medical centre and the three canteens were run by private enterprise under the supervision of the caves committee. There was a cathedral with its own choir and the caves had its own guides and brownies

In the 1960s, the caves were used as a music venue - David Bowie, Status Quo, Jimi Hendrix, The Rolling Stones and Pink Floyd all performed there. In October 1974, a lavish media party was held there to celebrate the launch of the new UK record company Swan Song Records, with the band Led Zeppelin. More recently, some of the tunnels have been used for the live action role-playing game "Labyrinth".

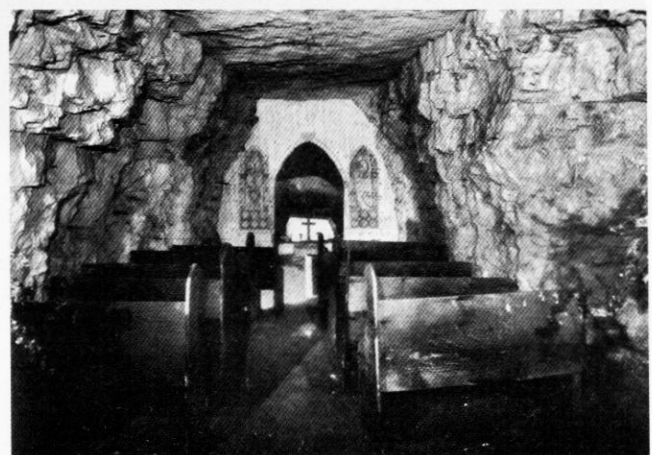
The caves have been featured on several television programmes including an episode of the BBC programme 'Doctor Who' from 1973 titled "The Mutants", an episode of "Randall and Hopkirk Deceased" and "Seven Natural Wonders" as one of the wonders of the London area, in an episode presented by Bill Oddie.

There is now a new building with a café selling food & snacks and a gift shop selling souvenirs. Our group was led by Rod down a long slope into the entrance of the caves; we stopped at the office used during the war where people were given their ticket and a number for their bed during the night of the air raids. We passed a table where current visitors are issued with paraffin lamps for the tour of the caves; however as most of our group had their own lamps and torches, we moved on to the map on the wall of the caves showing the "Saxon", "Druids" and "Romans" areas.

We then entered the deep part of the caves and were shown the location of the church, hospital, toilets, canteen and "druid altar"; we were shown all the carvings made by people over the years and the numbers painted on the walls where people had their beds; we were shown a deep slope which went up into someone's garden.

The visit lasted 90 minutes and Rod (who is a long-standing member of Subterranea Britannica) made our tour so interesting that we didn't realise how long we had been touring the caves when we emerged back into the day light.

Many thanks to Rod Le Gear for an extremely interesting tour and MC Black who had organised the visit.



The Chapel - picture Nick Catford

Bunkers in Latvia

Keith Ward and Nick Catford

On a recent flight to Germany, the Easyjet in-flight magazine included a feature about a Latvian Government bunker which was now a tourist attraction, stating that a tour company offered packages to visit it. In addition, the magazine also mentioned a bunker in Riga that is now a rifle range where visitors can shoot AK-47s and other guns.

After a few emails everything was arranged; and on 20th September 2007 twelve Sub-britters met at Stansted for the 06:05 flight to Riga. On arrival we were met by our English guide and driven the 75km to the bunker at Līgatne in a roomy Mercedes minibus. After passing through part of the old city we were impressed with the quality of roads, driving on well surfaced dual carriageway most of the way.

The bunker is situated at a health spa in a wooded area popular with tourists. It was first planned in 1968 for government officials and senior communist party members. At this time, Latvia was still a republic within the USSR, having been annexed by the Soviet Union in 1940; it regained its status as an independent republic in 1991 after the collapse of the Soviet Union.

Construction work took some years to complete and the bunker was finally ready for use in 1984 replacing a facility in the basement of the Ministry building in Riga.



One of two emergency exits from the bunker

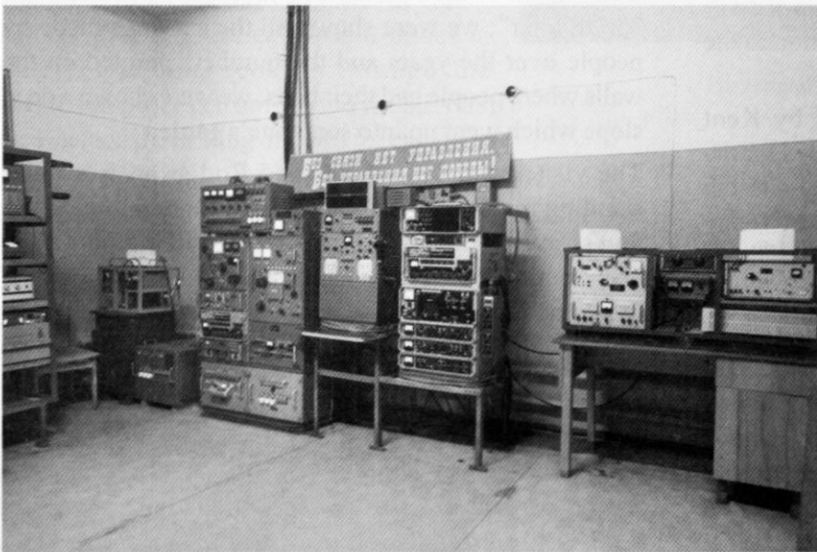
The site was closed to the public and fenced and guarded. After the formation of the State of Latvia the bunker was retained for use in wartime, however the spa was opened to the public and is now very popular with extensive wooded grounds to relax in. The bunker is still owned and under the control of the Latvian Ministry of Health and the Latvian public was only informed of its existence in 2003.

There was also a bunker for government officials in the basement of the Ministry building in Riga (a large 1930s building) and halfway between the two, a communications bunker serving both facilities. We think we saw this complex from the minibus, with curious shaped masts and a large brick blockhouse glimpsed through trees.

The bunker is entered through an anonymous doorway off the main reception area in the health spa; there are two emergency exits out into the grounds which are walk in tunnel entrances set into a grass bank. The bunker is about 30ft below ground with solid concrete on top. We were not convinced with the guide's description of the dimensions and depth which is intended for easily led tourists.

Our knowledgeable guide was employed by the health spa but she spoke no English so we had an excellent interpreter. At the bottom of a long flight of stairs down from the ground floor of the spa we went through a normal door and then through a series of standard Soviet blast doors passing along a doglegged passage and through an airlock into a ring corridor.

The single storey bunker is rectangular with rooms around the outside and a core of rooms in the centre. We initially turned left along the ring corridor passing some locked



Radio Room

The bunker which was referred to as 'the Pension' was hidden beneath a newly constructed health spa built for Communist Party and Government officials in typical austere communist concrete. To improve security anyone who was known to have relatives abroad was unable to work in the bunker while, very often, whole families were employed, including a husband, wife and children.

rooms still used by LatTel (the Latvian telephone company) to reach the first room of our tour. This is the radio room where seemingly ancient radio sets were still, according to our guide, fully functioning and ready to use if required. Next to this room is a communications and signals area with phones and desks and next to this the telephone exchange full of 1970's technology.

The next room was the map or planning room with situation maps showing military and civil headquarters, bunkers etc. and predicted fallout patterns. In the centre is a large plotting table with a map of the Latvian State with army locations marked. Opposite is a conference room with a teleprinter annexe. On the wall there is a map of the State showing regions and a bust of Lenin. A series of adjacent rooms to the left are empty and would have been converted into a medical facility in an emergency.

At the top of the corridor there is a communications area with teleprinters and a phone that we were told was the direct link to Moscow. This was the Communist Party communications area and the 'most secret' part of bunker where encrypted messages were transmitted. In one of the communications rooms there is a slogan on the wall in Russian which reads "Without communication there is no order. Without order there is no communication."

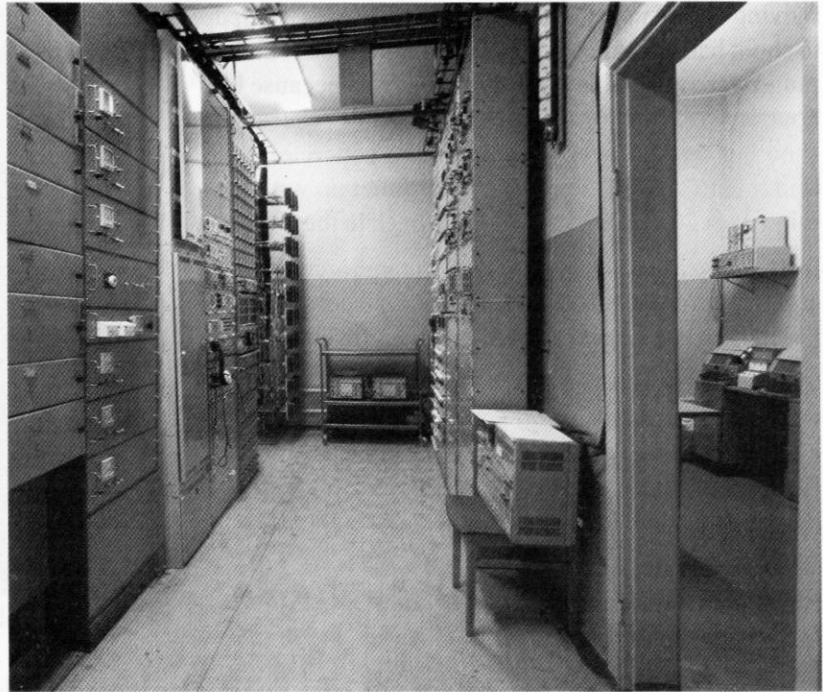
At this point a tunnel leads from the ring corridor to one of the emergency exits, passing through a decontamination area and blast doors; in the event of war this would have been the main personnel entrance into the bunker.

Halfway down this tunnel is a plant annexe; one room contains air conditioning plant with a line of Russian floor standing filters; in another room there are three standby generators. This annexe is outside the decontamination area, although there is a further blast door before the tunnel exit is reached.

At the top end of the ring corridor is the kitchen and canteen area with about ten tables and an ancient kitchen that makes our RGHQ kitchens look "state of the art".

In the central core of the bunker are the living quarters and offices for senior Communist party officials with sleeping accommodation and a bust of Lenin (one of 3 on site!) In the main office there is a small map room adjoining with similar maps to those seen in the main map room.

This concluded our tour of the bunker which is a huge facility well worth visiting. It is one of the best I have seen but the guides really need to stop fobbing visitors off with the claim that the bunker is still 'ready for use' if required.



Telephone Exchange

Interestingly the tour company that arranged our visit has never had a group just coming to see the bunker, its normally tagged on to holiday tours or 'stag' weekends which are very popular with the British as beer is cheap. We were given extra time at bunker rather than visiting a paper mill which is part of the normal tour.

In the grounds surrounding the main health spa numerous ventilation shafts show that the bunker extends for some distance beneath the car park. There is a circular helipad now used for basketball and a guardhouse at the entrance gate. The perimeter fence was not very high and would have given little protection.

A tasty lunch was served up after a delay - as the spa staff had not been told it was part of our tour, then we set off back to Riga City. Just outside the main city in an industrial area we came to the 'shooting' bunker - the second visit of our trip. There are three entrances of concrete stairwells with blast doors forming an air lock at bottom of the stairs; wooden sheds cover the top of stairwells. The underground area is divided into two long and one short range with toilets along a short corridor. We were not sure of the purpose of the bunker; I feel it was a public shelter, although our guide thinks it was for ammunition storage. It could have been used for ammunition storage for a local home defence army unit.

Those who chose to shoot (expensive at £50 per head) opted for what is known as the 'Arnold Schwarzenegger' shooting package which involves shooting six rounds from a series of guns including a Glock automatic pistol, a Winchester pump-action shotgun (6 shots), Franchi SPAS 15 automatic shotgun, a Saiga automatic rifle and a Kalashnikov AK-47 derivative. This uses major components of the famed AK-47 such as the barrel and

moving components. Those in our group who wanted to shoot had a whale of a time although the staff at the range were miserable but I think that was because by now we were running well behind schedule. Those not shooting walked over the impressive concrete river bridge into the old city where we all met up with the minibus at 20.00 for the short drive back to the airport.

Riga is a pleasant city with very Germanic architecture and lots of good eating and drinking places; a lot of EU money has been ploughed into its rejuvenation.

Our flight home was on time until we got to the ‘chaos’ that is UK Border passport control at Stansted with a long wait in long hot corridors, welcoming us home to Britain! It was a very long day most people getting home well after midnight after a predawn start, but well worth the effort.

All pictures by Nick Catford



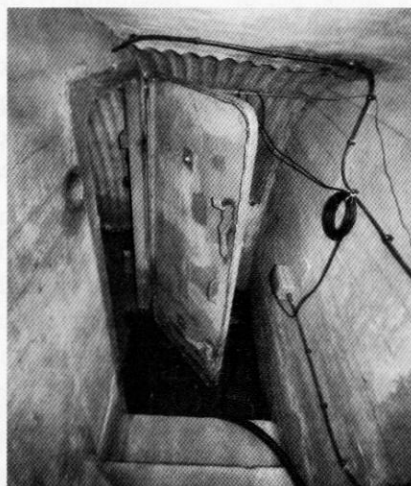
Airlock at the entrance to the ‘Shooting Bunker’

A domestic air raid shelter in Gerrards Cross

Nick Catford

An unusually sophisticated WW2 underground air raid shelter has come to light in the rear garden of a private house at Gerrards Cross in Buckinghamshire.

During WW2, domestic air raid shelters usually came in three types. The Anderson Shelter (named after its designer John Anderson) was made from straight and curved galvanised corrugated steel panels, which were bolted together. Six curved panels, bolted at the top, formed the body of the shelter and the straight panels formed the ends, with a door located in one end. The shelter was partially buried in the ground.



The entrance to the shelter

Brick built shelters had reinforced concrete roofs. They were often built in gardens or back yards and were sometimes partially below ground.

Morrison Shelters was named after Herbert Morrison, the then Minister of Home Security. They were indoor steel shelter, assembled from a ‘kit of parts’ and bolted together inside the house. The steel top doubled as a table and there were wire mesh panels around the four sides, with an entry door through one of the panels.

It is unusual to find a totally underground air raid ‘trench’ shelter built to a standard normally reserved for public or ‘works’ shelters.

The Gerrards Cross shelter is in an excellent state of preservation and is sited at the side of the garden of a moderately sized detached private house. The shelter is completely below ground and accessed by a flight of concrete steps turning through 90 degrees to a steel gas tight door

which still retains its rubber gas seal. There is a circular hole adjacent to the door which could have been for ventilation or more likely a stove chimney.

The room itself is constructed of corrugated steel panels, similar to an Anderson Shelter and is approximately 12 feet in length. At the rear of the room there is an aperture in the wall two feet off the ground. This leads to an offset emergency escape shaft with a steel ladder. The shaft has its original steel hatch, now sitting in the middle of a flower bed. The hatch has a ventilation grille in

the middle with a removable steel anti blast plate on the underside and is embossed with details of the Beehive Foundry (in East London) who made it.

From the emergency escape shaft a pipe leads to a small diameter ventilation shaft nearby, this has a removable carbon filter still sitting in the top of the shaft.

The owner has installed electric lighting in the shelter but has no plan to use it for anything.

The exact location of the shelter has been withheld at the request of the owner.



Pictures by Nick Catford

The carbon filter

The Roedean School tunnel and rock-cut boathouse, Sussex

Paul W. Sowan

Roedean School (an exclusive private establishment for girls) was started, with ten pupils, in a private house in Brighton in 1885, and within 10 years had expanded to occupy several such properties in the town. By 1897 the School had purchased an 18 acre estate on the cliff top to the east of Brighton at TV 350032 and on 16th March that year commenced the construction of purpose-built premises for a much expanded establishment. The new buildings were fully operational by January 1899. Additions to the estate were made in 1905, when a further 24 acres were secured, and 1930. Some two acres of land was lost as a result of road widening in 1930: the present A259 main road lies between the school and the cliff edge.

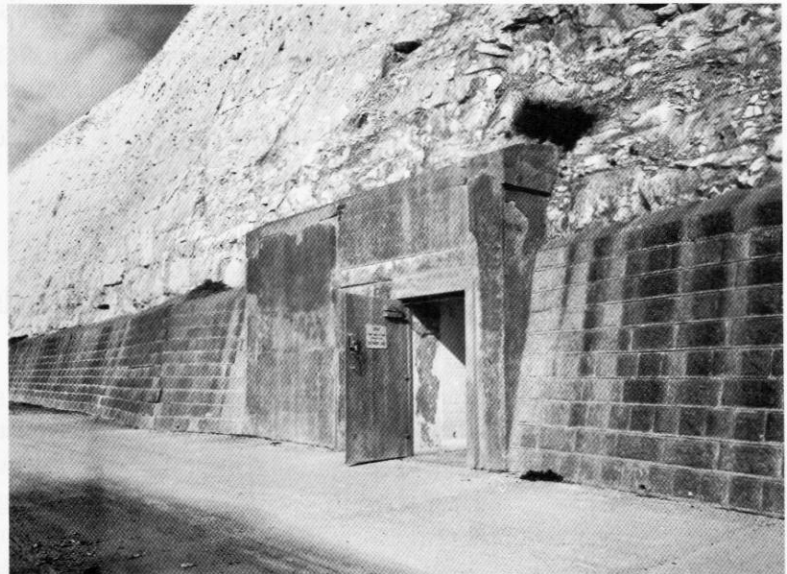
In the early years there was some anxiety about the southern boundary, formed by the public road running alongside the cliff edge. Marine erosion had regularly caused massive falls of chalk, and the loss of parts of the road, from time to time. However, Brighton's need to protect its outfall sewer and its main coastal road eastwards at this locality guaranteed the security of the school grounds, as effective sea defence works were put in hand from 1906 onwards.

By 1910 a tunnel had been excavated inside the cliffs to link the school with the beach. A history of the School published for private circulation in 1955 refers (pages 49 – 50) to a tunnel from the school grounds to the beach at the foot of the cliff:

The Firm [Messrs. Owens & Case] had additional work done on the cliff when the Tunnel was constructed, the chalk being trimmed to a safe angle above the exit platform. About the Tunnel, the construction of which Edmead, the school engineer, planned and directed so skilfully, that, begun from both ends, the two sections met in the middle with only a few inches of adjustment needed, Miss. [Penelope] Lawrence wrote in the Autumn of 1910:

The new tunnel leading to the beach is about 3 ft. wide and has 144 steps. At the bottom is a small sheltered platform with access to the beach and to a boat-house excavated in the base of the cliff. We look forward to sea-rowing and sea-bathing in the summer:

For nearly twenty years the Tunnel facilitated, if not sea-rowing nor as much sea-bathing as P.L. expected, yet a great many pleasures accruing from the private way to the beach.



The southern entrance to the tunnel at the base of the cliff

But two changes came with the extension of the boundaries of Brighton to include Rottingdean and Ovingdean in 1928 and the Planning Committee's comprehensive scheme for work on foreshore and roads.

First, against the new sea-wall which so strongly defends the Roedean cliff, shingle accumulated so that little bathing-beach was left. The former privacy too was gone when the Undercliff Walk, topping the sea-wall and connecting Marine Parade with Rottingdean, offered its amenities to the general public with whom the school now [1955] shares the sunny, sheltered walk with the sea close at hand.

During World War I (1914 – 18) the school continued to function, but 'The Tunnel entrances were guarded and Special Constables took shelter at the top of its steps while keeping watch for lights that might be shown illicitly on land or sea. But possession and enjoyment of the School's buildings and grounds was undisturbed.'



Looking up the steps towards Roedean School

In the two years before the start of World War II (1939 – 45) shelter trenches were dug in the grounds, and the tunnel was also used as an air-raid shelter:

For the Tunnel, which was used by Number Four House, rubber cushions were provided to mitigate the hardness and occasional dampness of the steps.

The school was evacuated during 1940, when the Army took over the premises followed, in 1941, by the Navy when the

establishment became HMS Vernon. The buildings returned to their original purposes when the school moved back in 1946. The School's history appears to record nothing of the tunnel's use during the war, or condition thereafter.

SOURCE: Dorothy E. DE ZOUICHE, 1955, *Roedean School 1885 - 1955*. Roedean School: iv + 225pp.

Both photos by Nick Catford

Local Legends

John Burgess

It is true to say that wherever you go in this country, someone, somewhere (usually a pub) will be able to proclaim in all sincerity their knowledge of 'the secret passage' that runs from the monastery to the big house over yonder - or something very similar. As members of *Subterranea Britannica*, hopefully we are not too easily taken in! One such tale, I first heard when I was about fifteen, concerned the Church at Ellingham, just North of Ringwood in Hampshire, being linked to the manor house called Moyles Court by a secret underground passage. This was held to be absolutely true according to local legend. Of course the mere fact that the two buildings were three miles apart was easily ignored. The other small point of this secret tunnel having to pass under the river Avon, through the alluvial soil of the valley was equally disregarded!

No doubt your own locality boasts such marvels of underground myths, as does my home town of Lyminster on the South Coast. According to many people the town is riddled with 'smuggler's tunnels'. Why any self respecting smuggler would want to take the trouble to build a tunnel in the first place is easily overlooked. As are the deserted landing sites on the five miles of open marshlands and accessible shoreline either side of the town.

Most local 'tunnel' stories do have some historical foundation but over the years the romantic idea of something clandestine has replaced reality. During the Victorian era there was much rebuilding and development carried out in many towns. In the preparation of sites, remembering their penchant for including cellars to properties, quite often a brick built tunnel would be discovered. Legend usually then has it that; 'a man and a boy went down the tunnel and were never seen again'! Or; 'a man and a dog/duck set out to explore the tunnel and the dog/duck were found wandering along a lane two miles away!' If the man actually returned, he would most likely say that the tunnel had collapsed at a point further along where the bricks disappeared. The discoverers then looked along the line of the 'tunnel' and as it appeared to head in the direction of the 'church, monastery, convent, castle, or manor house etc. regardless of how far away this was.

Reality suggests however, that many of these secret passages were actually Tudor drains. These were normally brick lined, about two feet wide and about three feet high. In other words, a passage passable at a low stoop. The perceived 'collapse', or the end of the brick lining, was usually just a soak away at the end of the drainage channel. What the Victorians could not believe, was that anything so sophisticated could have been constructed prior to their own era. To put this into perspective, remember that during this period the patent office in St Petersburg was seriously considered for closure, because it was felt that everything that could be invented had been invented!

What my project will try to do will be to investigate and research the Lyminster 'smugglers' tunnels and report my findings through a series of articles. I will include details of my approach to the residents and shops of Lyminster in the next issue of *Subterranea* and also report my findings at the Spring Day Conference.

Should you have a local legend in your area, this is how to go about preparing and carrying out such research. The first step is to listen to the legend again and simply to ask the question; 'Are there really tunnels here?' and see what the answer is. Next comes some serious analysis of the responses. What is the likely basis for the wild tales - there is usually some element of fact hidden in there somewhere. Then you need to go to the local museum, or possibly a local historian and establish what they know and their interpretation of the rumours. Then research local guides and history books and keep a record of your findings. When you are sure of your facts - and have accumulated enough knowledge to make an assumption of the true nature of the underground feature - you can then approach the owners of properties above or around it. A letter is the best medium for introducing yourself and to explain what you are about. Remember that one must always ask for permission to enter any private property. If you ask politely and explain the reasons for your interest you will find people are nearly always friendly and helpful.

Please tell me about your own local legends and we may include them in future articles in this series.

Please write to me at PO Box 18, Lyminster, Hampshire SO41 3XE or e-mail: john@advertisingconsultancy.uk.com



Day Trip to France March 2007

Jane MacGregor

Last March, Bob Clary organised a trip to the Normandy coast to look at the Atlantic Wall and D-Day defences. Robin Ware and I met up with him, Richard Savage and Nick Catford on the previous evening to catch the overnight ferry from Portsmouth to Caen, from whence it was straight to the Atlantic Wall.

Our first port of call was Sword beach to look at the little gun emplacement there before heading up the coast to look at the Longues Sur Mer battery. There is a small information centre there, but we had arrived well before the tourists and staff in order to get the best photography.

The battery still has its four guns in situ. The 152mm guns were built in 1928 and have a thirteen-mile range. They could fire six shells per minute, and have a thick steel plate around the gun for protection. The four concrete gun emplacements are in good condition for their age and history, and like most of the buildings we saw, have the distinctive German military architecture reminiscent of some of the structures at Zossen-Wunsdorf and Berlin. The concrete is very thick, strengthened with rebar and iron plates on the ceilings. From the outside, squarish recesses are sunk into the surface in which clumps of grass were planted for camouflage. The Fire Control observation point is set forward of the guns with a mortar launcher nearby, and has an excellent view as it is perched at the top of the cliff. From there we drove off to look at one of the Mulberry Harbours, where the concrete pontoons are still out at sea, and Omaha beach. At Omaha the sites are not easily accessible.

Pointe du Hoc, our next port of call, had seen action prior to Operation Overlord when the Allied forces bombed the site in April 1944. One gun was destroyed and the remaining artillery was moved further inland in response to this. By D-Day, two of the casemates had been completed, but the guns were not installed. The site today has a few mostly complete positions and an intact Fire Control Position, which has had a modern stairway fitted to enable people to climb the tower. The ground is extremely uneven as it is full of craters from the 1944 raid.

Along the coast at Ains de Poulet, the headland has a rocky outcrop, and the present road was a railway back in the 1940s. The Germans installed four 150mm railway guns after their occupation of Normandy in 1944. The double curve in this section of track made it a good site for the gun position. The rocky outcrop has a tunnel driven

into it, and inside is a former concrete structure. This was intended as a secure ammunition store and the railway ran around the outside, not through the tunnel. We wandered in and found, as well as the straight tunnel, two branches. One descended below the level of the main

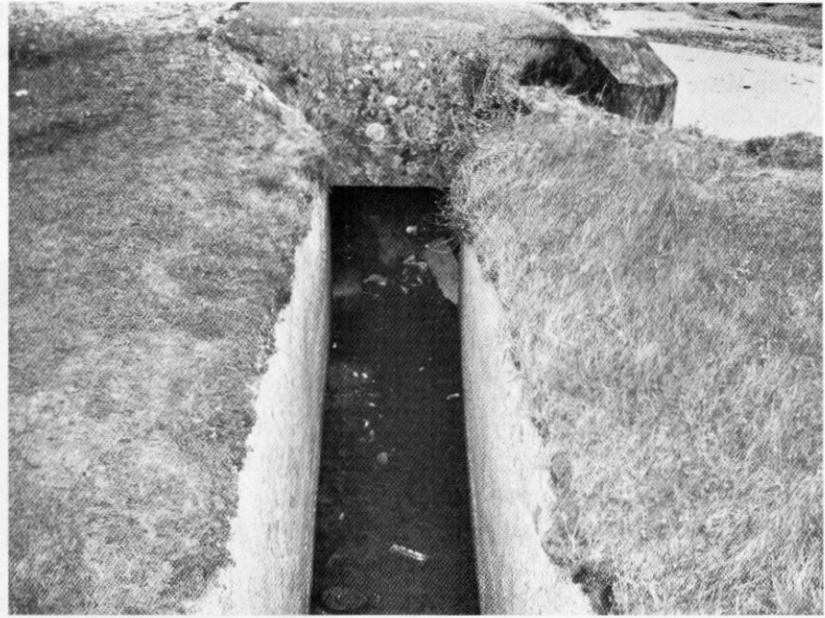


Fallen pillbox at Neville Blankensee

tunnel and forked into two, ending in blind walls. The second was very narrow at the entry point and also went in two directions. The roof was as low as three feet and again, both ends were blind drives, one quite wet. On the opposite side of the road is a former bunker, which has little of interest. The railway was closed in 1947, being in a poor state of repair.

The next site was known to the Germans as Sea Eagle, but to the French it is Le Fort la Batterie Brulay. It was originally constructed at the turn of the century by the French as a defence against the British (for some reason they thought we might not be keen on them). As it already had 94mm guns installed in open casemates, this was something of a bonanza for the occupying troops, who merely took over the site and continued to use it even after the additional sites were built to the east. The gun mountings are still there, one with severe stress fractures, and the imposing Fire Control tower remains standing. This is four storeys high and, when fitted with its telemeters during the war, had a very good view of any shipping that could have come close enough to pose a threat. As the guns were located behind the tower, the distances to fire would then have to be manually calculated for each gun. The ammunition bunkers are covered with graffiti, which is a shame as there were once paintings from the occupation on the walls.

The nearby radar site, which was known as Osteck, was an important look-out position. The two Wurzburg radars were defended by flak positions, gun emplacements and 150mm searchlights. It is now on a sandy heath which is overgrown with gorse and has an off-road motorcycle track running around the site. The vegetation and the land relief mean that a lot of the structures are concealed, so we went on a full-scale bunker hunt. The motorcycle track is helpful for navigation, and by the parking area to the track are a number of gun emplacements in good condition. We walked up to the overgrown area and found several bunkers which had all been badly damaged, and almost invisible in the gorse and scrub. As often happens with these Nazi-built bunkers, attempts to destroy them have not succeeded,



Trench at Havre de Houarvi

but resulted in twisted rebar and hanging pieces of concrete in bizarre configurations. The only way to get in to these buildings was to climb up (or down) the shattered concrete. Several of these opened at one end. It is known that there were machinery bunkers and generators here, so this may have been for exhausts. One bunker, still in fairly good condition, contained sumps and a machine bed although all the plant is long since gone. This is a good site for exploring and one could easily do a day here; it is an extensive area and it became necessary to locate each other by mobile 'phone in order to regroup and go on to St. Pierre Eglise.

The Germans were working on development of radio guidance systems throughout the Second World War, and at St Pierre Eglise there was a small cluster of six bunkers for this purpose. They are now in the middle of various farmers' fields, so we strolled quickly past some rather bemused looking cows to gain access. With plinths for the radio equipment, these resemble early experimental radar bunkers. One has the paintwork in near-perfect condition including the wording for Notausgang. Up to this point the sites were relatively close to each other, but we now had a longish drive to the extensive fortifications at Neville Blankensee.

These were a delight to roam around. This area is suffering from severe erosion and has lost several structures to the sea. The guns here included some British Vickers guns which were captured from the Channel Islands in 1940-oops! The emplacements are linked by concrete tunnels and are spread over a wide area. Some have already fallen

onto the beach, but are still accessible- so we could crawl along tunnels lying on their sides, gradually filling with sand. There are old pipes and ventilation ducts by some of the fallen tunnels. We spent longer here than we intended to as there was so much to see and photograph, so when we eventually got moving again the pace increased. We made a quick stop at Gatteville where two gun emplacements have been converted into summerhouse-type holiday homes, with a window installed in the gun aperture.

The site at Havre de Houarvi was interesting as it was very different to the gun emplacements we had seen so far. It is suggestive of a World War I location as its main feature is a series of trenches, approximately a three feet wide and six feet in depth. These are constructed from reinforced concrete and interlink a series of gun emplacements for machine-guns and mortars. Although the western end is accessible and well worth a look, the eastern end of the site is now occupied by a commercial fish farm, which uses one of the trenches as an outfall. With the light failing, we just had time to visit two more sites which are looked after and preserved, before a mad dash to the ferry. By all accounts it was a very rough crossing home, but we all slept through everything!

Thanks to Robin and Richard for trying to haul me up a twelve-foot wall, and very special thanks to Bob Clary for organising a very interesting day and doing all the driving so the rest of us could doze between guns.

Both photos by Jane MacGregor

The Potash mine at Boulby, Yorkshire coast, in context

Paul W. Sowan

Introduction

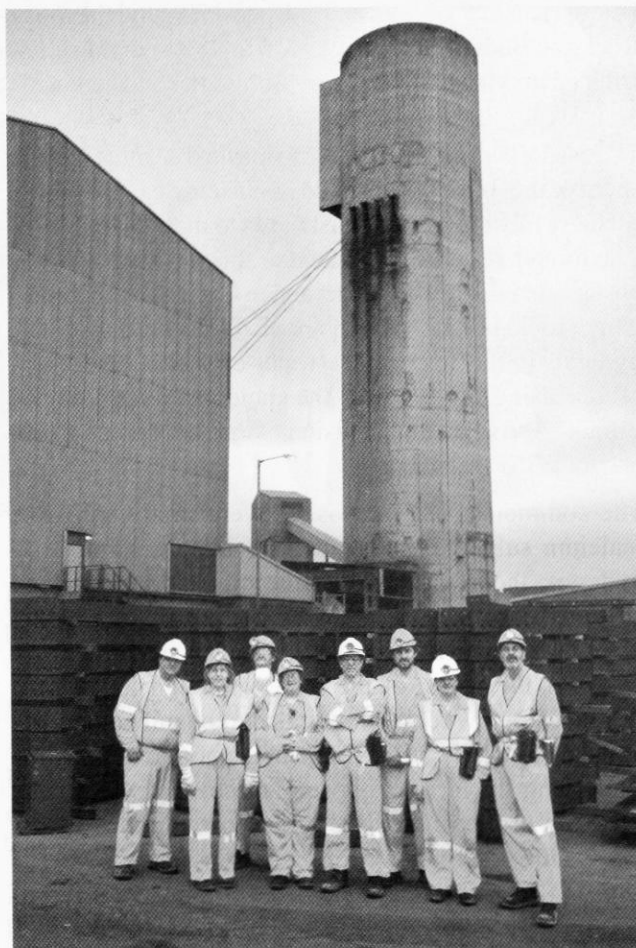
How low can you get? A small party of Subterranea Britannica members made it recently to 1.1 kilometres vertically down a hole, and 11 kilometres out underneath the bed of the North Sea. Linda Bartlett, Nick Catford, Martin Dixon, Jane McGregor, Sue Monsell, Paul Sowan, Gerald Tagg and Robin Ware visited the potash mine at Boulby, the United Kingdom's largest and deepest working mine, on Friday 26th October 2007. Most drove, but two went up by train. Sue was both unlucky and lucky. The bad news was a breakdown, and the good news that it didn't happen until she reached Staithes, barely a mile down the road from the mine. Further good news was that there was a garage there to fix the car, and the bad news the bill at the end of the day.

Location

The mine is at Boulby (NZ 7618), a kilometre inland from the Yorkshire coast on the A174 road between Saltburn-by-the-Sea (10 kilometres) and Whitby (16 kilometres.) The coast here is dramatic, the cliffline being punctuated by deep gorges conveying streams to the sea. Boulby Head is, at 203 metres, said to be the highest sea-cliff in England. There is much of interest to geologists, and there is a published excursion guide (Rawson, 1992) which includes details, *inter alia*, of the Staithes to Port Mulgrave section. There are numerous relics of former industries including ironstone mining, jet mining, and sites where alum was once manufactured from shale. The Tom Leonard Mining Museum is at an old ironstone mining adit at Skinningrove nearby. This seems to be a most promising area for a future Subterranea Britannica Study Weekend.

The Whitby, Redcar & Middlesbrough Union Railway

The mine is served by a freight terminus on what remains of the former Whitby, Redcar & Middlesbrough Union Railway. This line, with a very scenic coastal route, was authorised by Act of Parliament in 1866 but not completed and opened until 1883. The stretch from Middlesbrough via Redcar to Saltburn-by-the-Sea remains open to passengers, although the remarkably handsome station building at Saltburn is now occupied by commercial concerns, trains now stopping some metres short of it at a single platform with a 'bus shelter' style structure. Beyond this the line was closed to passenger services in May 1958, but re-built and re-opened as far as Boulby to serve the mine in 1974. This freight-only section runs from a junction just short of the Saltburn terminus via Loftus and Brotton (where the Corus steelworks has a terminal), thence the 992-yards Grinkle tunnel (NZ 7417) to Boulby. At one point the line is extremely close to the



Sub Brit party in front of the shaft head. The winding house can be seen on the left – Photo by Neil Rowley

cliff top edge. Beyond Boulby the line is closed, but ran via Staithes and the Kettleless (NZ 8315) and Sandsend (NZ 8513) tunnels, and Sandsend to Whitby. Several imposing iron viaducts, such as that at Staithes, have been demolished. Potash trains commenced running from Boulby to Tees Dock near Billingham in May 1974.

Geology

The Yorkshire coast is a classic locality for geological exposures and fine scenery. The geology of the region has been described by Vernon Wilson (1948), Dorothy Rayner and J.E. Hemingway (1974), Sir Peter Kent and others (1980), and Peter Rawson and John Wright (1992), and related to the overall context of English geology by Duff and Smith (1992.) Details specifically on the beds of Permian age (containing the potash) have been published by Smith (1974b)

Middle and Lower Jurassic beds (including the ironstones formerly mined in this area) outcrop southwards from Redcar, overlying Triassic and Permian strata at depth. The thickest evaporite beds are in the Upper Permian, the generalised succession being as follows:

Upper Permian Beds

Carnallitic Marl
Potash Beds
Rock-salt Beds
Billingham Main Anhydrite

Composition

Marl containing magnesium potassium chloride
Up to 45% sylvinite (potassium chloride) – the potash mine panels are excavated in this bed
Up to 95% sodium chloride – the access roadways are driven in this bed
Anhydrous and hydrated calcium sulphate – this bed is not exploited

The evaporites mined here were deposited near the western shore of the former landlocked Zechstein Sea, and extend offshore most of the way eastwards to mainland Europe. The former sea occupied much of the present North Sea basin, extending to the Baltic, and to Germany and Poland where rock-salt and potash are also mined. The soluble minerals in this ancient sea-water crystallised, in order of increasing solubility, as the ancient sea dried up and shrank. A smaller-scale version of the same process now occurs at the Dead Sea.

The commonest salts deposited were firstly anhydrite (calcium sulphate) and gypsum (calcium sulphate 2-hydrate); then fairly pure halite or rock salt (sodium chloride); and finally potash or sylvinite (potassium chloride) mixed with halite and some clay. The high value potash is the object of the mine, although for reasons explained below rock salt has also to be mined to reach it. At this locality, it would be uneconomic to mine the underlying anhydrite or gypsum: these more widespread minerals are extracted from shallower mines in the Derbyshire / Nottinghamshire, East Sussex, and Vale of Eden (Cumbria) areas. Other salts also occur but are of no economic interest, including carnallite (a hydrated double salt of magnesium and potassium chlorides) and polyhalite (a hydrated triple salt of calcium, magnesium and potassium sulphates.) Another mineral species present, somewhat problematic, is boracite, a magnesium borate.

The evaporite beds, progressively thicker, extend out below the bed of the North Sea. In the opposite direction, progressively thinner, they extend inland for some distance, but (as the evaporites are by definition soluble in water) they are replaced at outcrop by breccias resulting from overlying beds collapsing as the salts were dissolved away. Much detail concerning the evaporites (Smith, 1974a) has been published.

The Permian System (named by the British geologist R.I. Murchison in 1841, from his work in the Perm Region of Russia) extend from about 280 to 225 million years before the present. The landlocked Zechstein Sea was drying up, leaving salt flats, towards the end of that period.

History of mining in the district

Historically, the earliest mines in the district were probably the rabbit-burrow-like mines made in searching for jet (a hard polishable anthracite which could be carved into ornaments.) This was especially popular in Victorian times for costume jewellery, particularly at funerals. There were numerous workshops in Whitby devoted to this trade. Alum (hydrated aluminium potassium sulphate) was also manufactured here, from shale dug at the surface. Both the alum shales and the jet were derived from the Upper Lias (Lower Jurassic) rocks outcropping in the coastal cliffs.

On a more industrial scale, there were in the Cleveland Hills and along the coast numerous drift mines for ironstone. Port Mulgrave, south of Boulby, was built in the 1850s to handle the ironstone trade. The Cleveland ironstone mines were producing some two million tons per annum by 1939. Some of these mines are reputedly still accessible, although problems with bad air (carbon dioxide) have been reported.

A little coal was once mined at Danby in Eskdale.

Investigations (Wilson, 1948) before World War II, primarily to locate possible oil reserves in Britain, led to boreholes proving the existence of Upper Permian beds containing bedded evaporite minerals (principally halite, gypsum, and anhydrite) at considerable depth below the Cleveland Hills.



Rock bolting in progress – Photo by Paul Deakin

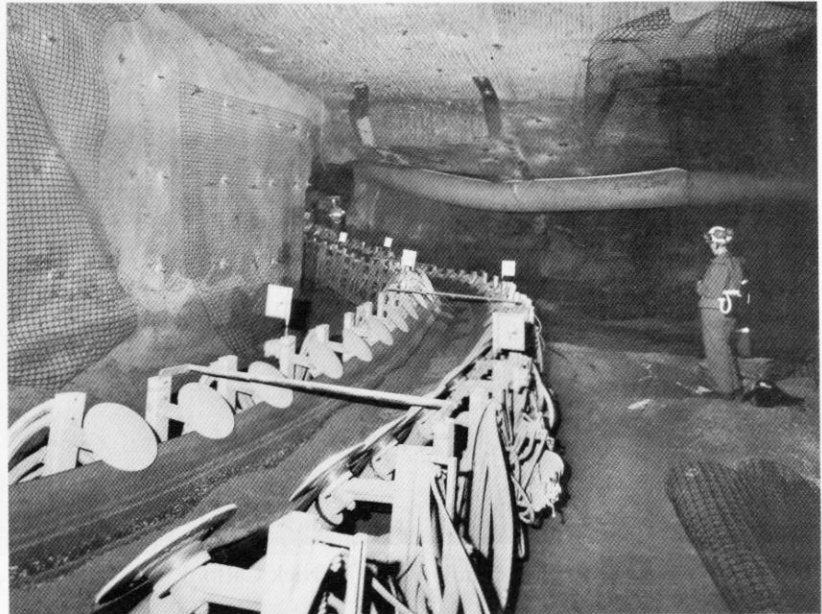
The first really deep shaft mines were to exploit the seven-metres thick anhydrite at the Billingham mine, worked on the pillar-and-stall system from 1930 to 1971 when the mine closed. It has also been mined at the Warren Cement Works mine at Hartlepool. The mineral was used in the manufacture of sulphuric acid, and of ammonium sulphate fertiliser. A shallow pillar-and-stall mine for gypsum was operated for some time at Sherburn-in-Elmet.

Salt was extracted by the evaporation of sea-water (on sunny days!) on the tidal flats of the Tees and nearby from very early times (as indeed suggested by place-names such as Saltburn.) Rock-salt was first detected in a deep borehole at Middlesbrough in 1862, with production starting at Port Clarence (north of the Tees) in 1874, and at Middlesbrough, North Ormesby and Eston at various dates from 1886 – 89. Production at these three places peaked at about 63,130 tonnes in 1894, but had declined to about 21,000 tonnes by 1918, and has subsequently ceased. Uncontrolled solution mining of common salt, predictably, gave rise to some ground stability problems. It was followed by more controlled brine-pumping designed to leave carefully planned and spaced solution cavities, some of which have been used subsequently for the storage of natural gas. By 1974 solution mining was restricted to the coastal flats some four kilometres north of Middlesbrough. It was the common salt, however extracted, that led to the concentration of heavy chemical industries in the Middlesbrough – Billingham area, where amongst other materials chlorine, caustic soda (sodium hydroxide) and sodium metal were manufactured, not to mention numerous derivatives.

History of potash mining

Potash was first discovered locally in 1939 during the drilling of a bore in search of oil at Aislaby, near Whitby. Subsequent exploration from about 1948 - 1955 demonstrated substantial reserves at depths of 1,100 to 1,200 metres, but these investigations ceased as it was assumed that the material could not be exploited economically at such depths. It was established that the potash beds were somewhat variable, containing from 26% up to 45% of potassium chloride. From 1962 consideration was given to recovering the potash by solution mining – pumping water down to dissolve the material, then pumping the solution back to the surface. This option was not adopted.

The first deep shafts were sunk at Boulby by Imperial Chemical Industries in 1968 / 69, with potash production commencing in 1973 / 74. The beds, up to seven metres thick, were mined initially by pillar-and-stall mining.



Conveyor – Photo by Paul Deakin

Production at the outset was of the order of 7,100 tonnes per day, rising in 1974 to around 1,000,000 tonnes per annum.

Subsequently the mine has been worked by Anglo-American, and by Tarmac, but is now operated by British Potash Ltd, a subsidiary of Israel Chemicals Ltd, which concern also has deep mines near Barcelona in Spain. The mining method now in use is described below.

A general overview of potash mining and technology has been provided by Garrett (1996).

The mine surface buildings and site

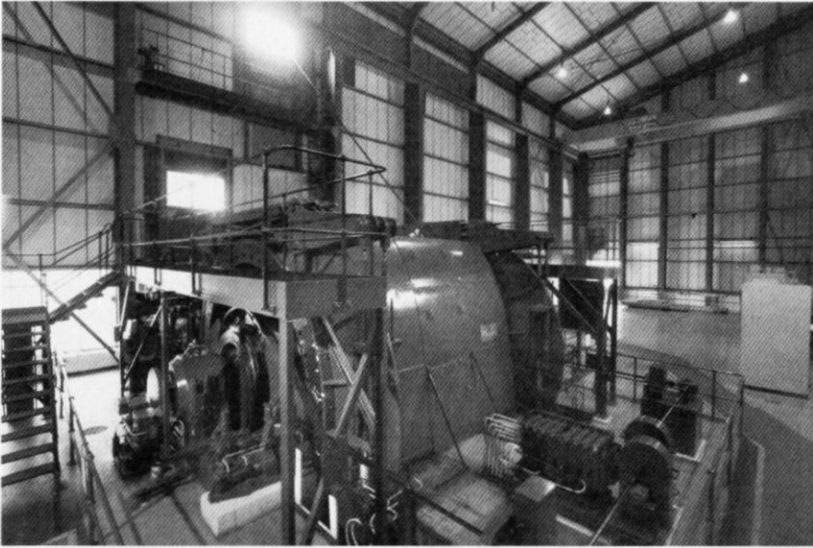
The mine buildings stand in open farmland, and straddle the sites of two earlier, and much shallower, ironstone mines. The buildings comprise a winding-house; two shaft-tops; extensive processing plant sheds with a tall chimney discharging ‘steam’ from the drying plant; and separate loading stations where potash and rock-salt are separately discharged to rail waggons for transfer to Tees Dock, where much is exported by sea. There are also numerous support buildings. Some stockpiled rock-salt is stored on site, as the material is applied almost exclusively for salting icy roads in winter.

The mine is worked in three shifts, 24 hours a day, seven days a week. Of the 930 staff, 620 (including two women) work underground. Women also work in the separately administered Dark Matter Laboratory. Workers’ ages range from 25 to over 60.

The mined area extends at present over 96 square kilometres, the greater part of it northwards below the bed of the North Sea.

The briefing

The day commenced with coffee and a first-class briefing by Neil Rowley one of the senior mine engineers, who explained what seemed like every conceivable aspect of



The winding drum – Photo by Nick Catford

Down the shaft

There are two shafts (each 1,100 metres deep) close together, and a winding-house. One shaft is primarily used for ore extraction, the other for access and supplies. The steel winding ropes (two to each cage or hopper) are inspected daily during a morning maintenance shift. The mine is ventilated by blowing fresh air down the manriding shaft, rather than extracted from the upcast shaft. It is directed around the mine by means of oiled canvas or polystyrene block brattices, and in places conducted over or under roadways by ‘air crossings.’ There is no radon, although some methane, nitrogen, hydrogen sulphide, and higher hydrocarbons are encountered in small quantities.

the local mining scene in general, and the operation of Boulby mine in particular. His career history had encompassed some years working as a mining engineer in the Selby collieries complex. There then followed the safety briefing, specifically the use of self-rescuers for protection from carbon monoxide. It may be wondered what there is, other than in a coal mine, to catch fire underground. The answer is, of course, primarily many kilometres of heavily insulated high voltage cables. An electrical fault, setting fire to the insulation material, can result in very large volumes of very dense smoke in a surprisingly short space of time. Visibility can quickly be reduced to almost zero, and incomplete combustion can lead to the generation of the exceptionally toxic gas carbon monoxide.

The shafts are sufficiently wide to allow complete landrovers to be lowered down. About 60 of these vehicles are used in the mine (and left there when no longer serviceable.) Large machinery has to be lowered down dis-assembled, and put together in the mine.

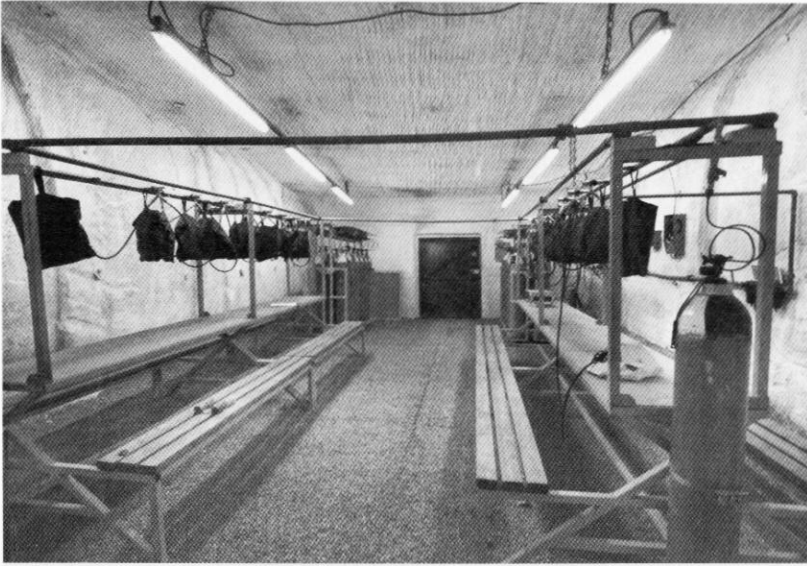
After a light lunch we all, as advised, visited the surface loos, having been warned there are none underground (but ‘there are plenty of dark corners!’) We were also equipped with bottled drinking water: dehydration is a distinct possibility, as the working faces are warm – 34° C at the under-sea district we were to visit, and 45° C in the inland district. For the same reason, we stripped down completely, wearing only the very light bright orange and dayglo miners’ clothes supplied. Next we were kitted out with self-rescuers, batteries, lamps, helmets, boots, overalls, earplugs, goggles, and dust-masks. The mining company supplied all this gear. It has an excellent safety record, and management had no intention of our party spoiling it! We were informed quite firmly well in advance not to bring our own clothing or equipment – welcome news for the two of the party who travelled up to Teesside by train. The only real formality in advance was to notify Neil of our boot and overall sizes.

Plummeting 1,100 metres was spectacularly smooth, in a lit but three-level crowded cage. A couple of minutes or so from the ‘off’ we passed the balancing cage, half-way, on its way to the surface. The party travelled back over 220 million years in geological time as they descended through the Jurassic and the Triassic beds into the Upper Permian. It took five minutes to reach the bottom. Ore skips are wound up the other shaft at more than twice that speed.

At pit-bottom, it struck us at first as chilly and draughty as, of course, we were standing in the ventilation air intake. We found ourselves in one of two parallel



Saturated brine pumped from within the mine – Photo by Nick Catford



Safe room – Photo by Nick Catford

roadways driven in the rock-salt bed, below the potash. This roadway, 3.6 metres from floor to ceiling and eight metres wide, is used for miners' and others' access to their working places. Land-rovers are used, and as we started our 11 kilometres drive to a working face we passed various underground workshops for machinery maintenance and repair, and other vehicles coming in the opposite direction from time to time. At pit-bottom we were over a kilometre down, but in one direction the route is further downhill to the lowest point about 1,350 metres below the ground.

En route to the face

On the way out to the face, we stopped several times for a walkabout, and to be shown various features. Rock-bolting is used throughout the mine, and how this was done was explained. Arrangements are made to enable persons, wearing activated self-rescuers of course, to find their way 'outbye' in thick smoke if needs be. High-reflectance guides and directionally-tagged ropes are prominent alongside the roadway. As it is so far from pit-bottom to working faces, there are from time to time, refuge rooms with airtight doors, equipped with large numbers of air cylinders and smoke masks and other safety equipment. There are six of these safe havens, each large enough and with enough air to accommodate 30 persons for up to six hours. Each has a telephone.

There are four production districts – three to the north under the sea, and one inland to the south.

At a working face

Still in the rock-salt bed, we examined a heading where core-sampling is done by probing ahead using a large drilling machine. By some clever manipulation, it is possible to sample above and below the bed in which the roadway is driven, as well as straight ahead. Samples can be taken up to two kilometres ahead. Those who wished, collected samples (inasmuch as they could be

identified) of potash, rock-salt, and anhydrite. The anhydrite, being a dull grey colour, was easy to identify. But we were advised that the best way to tell the difference between potash and rock-salt is by taste, as both materials occur in a variety of colours due to impurities such as clays and iron minerals. Both pure sodium chloride and pure potassium chloride are of course plain white / colourless crystalline materials. But neither the rock-salt beds nor the potash beds are 100% one compound or the other, and each can occur as clear, white, grey, amber, brown, pink or red material. Those wishing to sample the taste of potash need do no more than invest in some 'low-sodium' table salt (potassium chloride) which tastes salty but not quite the same.

We were warned that sylvinite is hygroscopic, and our samples would soon crumble if not kept dry at home.

There being no rock-cutting in progress at the time (work was in hand on a maintenance question) we then went to admire the machinery used. This mine is not worked by drilling and blasting, but uses very large machines with boom-mounted cylindrical cutting heads of the order of a metre diameter, and several metres wide, well-armed with tungsten carbide-tipped cutting teeth. The device has an integral collecting scoop which conveys the cut ore to the rear, where it is delivered to a most ingenious local conveyor system. These mobile, flexible local conveyors (looking like huge long centipedes without all the legs) can be twisted and turned to snake around corners and so serve any scene of operations without the need for a flock of dumper-trucks, such as generally found in gypsum mines, although some shuttle cars are used. The mobile conveyors are up to 65 metres long, which I think can be shortened or lengthened as required by adding or removing sections. They convey material to the main conveyors, and thus to the winding-shaft.

Into the potash bed

All the permanent roadways are driven in the rock-salt bed, as this material is mechanically strong enough (when rock-bolted) to afford good permanent tunnels. Thus it is that the enterprise has to mine low-value rock-salt, before it can reach the more valuable potash. Potash is mined five days a week, and rock-salt (to extend the roadways) the other two days, Fridays and Saturdays.

It was now time to drive up one of the numerous internal inclines to reach a 'panel' being worked in the potash beds lying above the access roadway ceilings. Around 10 – 12 metres thickness of rock separates the access roadway ceiling from the mine panel floor above. As the potash is a mechanically weaker material, the cavities left by mining it are, when mined-out, left to fall in, which

they tend to do within six months or so. The mined-out panels ultimately close up by floor-heave (about one metre in three months), pillar failure and ceiling collapse.

Here, similar mining equipment is used, and the main new point of interest was the interesting pattern of drives and in-situ potash support pillars left to keep the panel stable during its working life.

The potash-yielding bed has a thickness of about seven metres, but the mined cavities 3.6 metres high are designed to leave two metres of raw potash to form a ceiling. Above this is marl, which would not form a sufficiently secure ceiling.

The mined panels are 55 metres wide, three or four parallel roadways being driven forward with two lines of oblique un-mined rock pillars arranged *en echelon* left between them. Each panel is of the order of 600 metres long. About 3,000 tonnes of ore a day (an advance of 10 metres per machine per shift) can be mined from each panel.

It was certainly warm at the innermost end of the mine – much like a crowded London tube train, but more acceptable in that the air here is much drier (and not so smelly!).

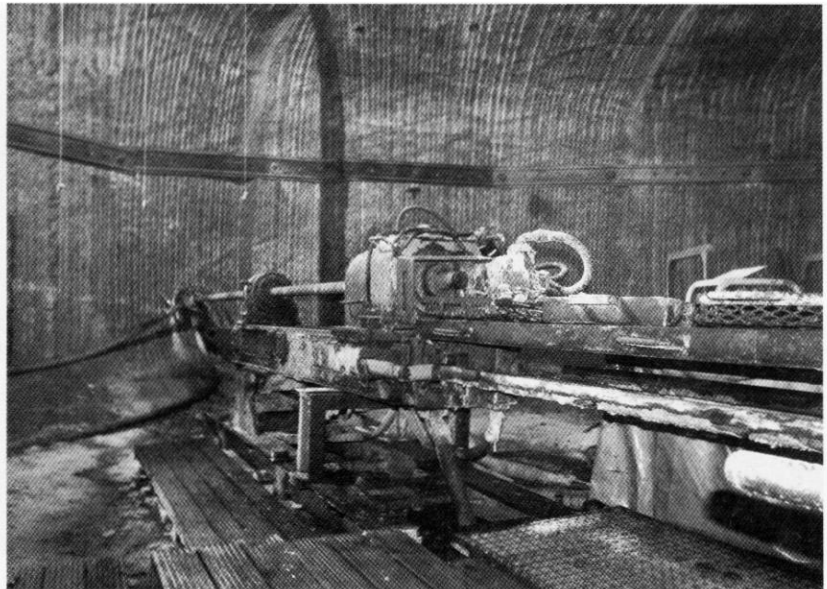
Back to the surface

Before getting back into the cage to get back to ground level, we toured the pumping plant. Most of the mine is extremely dry, but saturated brine (containing both sodium and potassium chlorides) is pumped to the surface from sumps at the lowest points, at a rate of 1,000 gallons per minute, and used in the processing plant.

Sadly, there was not time to visit the Dark Matter Laboratory near pit-bottom.

On emerging at the surface, we went to see the enormous electrical winding engine, the steel cable, and the men upon whom our lives in a 1,100 metre deep hole had depended. It is all controlled from comfy chairs in a cabin well-supplied with computer screens full of data from instrumented gadgets in and around the shafts. Then we watched enormous skips holding 45 tonnes of material each being discharged into hoppers feeding the processing plant. There was about a minute or a minute and a half between skips arriving at ground level, so they are clearly hoisted up the shaft more than rapidly!

Then back to the changing rooms for more than welcome showers, a photographic perambulation around some of the surface, a vote of thanks to our guide who had given up most of a day for us (about 10.30 to almost 16.00) and preparations for going home. We dropped Sue off at the garage in Staithes, where she found her car back to operable, and her bank balance significantly depleted.



Boring machine – Photo by Nick Catford

On-site processing

The rock-salt, apart from some crushing and screening to the customers' preferred particle size, calls for no processing. It contains around 95% sodium chloride and 5% clay.

The potash beds yield raw material containing 35 - 40% potassium chloride, contaminated by 45 - 50% rock-salt and 10 - 15% clay. This has to be separated from the common salt, clay minerals, and so forth. There was not time to visit the processing plant, but we learned that the separation (using saturated brine as a vehicle) was effected by froth-flotation. Crystals from the crushed ore, depending on which chloride they are, will or will not stick to air bubbles created using some sort of chemically seeded frothing agent. So one of the chlorides is floated to the top by the bubbles, and skimmed off. The other sinks, and can be sieved or centrifuged out later. The purified potassium chloride is then dried in large rotary gas-fired drying kilns, and then stockpiled and / or sent to the railway waggons. Something like 10,000 tonnes a day of raw potash is taken up the shaft. This yields around 4,000 tonnes a day of purified product.

Surplus salt-water with a little suspended clay, from which it is not economic to separate the common salt, is disposed of via a shallow shaft at the cliff edge and a mile-long pipeline out to sea. The argument is that you can do no harm adding salt-water to sea-water!

What is it used for? Where does it go?

Eight trains each day take rock-salt or potash to the Tees Dock. Most of the output goes into agricultural fertilizers: it is of course the K in NPK fertilizers (the N being nitrogen, and the P phosphorus.) Britain, thanks to Boulby, is more or less self-sufficient in potash, so large quantities (around 50% of production) are exported by sea from Tees Dock to Belgium, France, and elsewhere.

Rock-salt is taken by train to Tees Dock, and mostly sent by ship to English and Scottish east coast ports for sale to local authorities for de-icing roads. It supplies about a third of the UK's demand for this application. There are two other producers of mined rock-salt in the UK – the Winsford mine in Cheshire, and another at Kilroot in Northern Ireland.

Production is of the order of 2.8 million tonnes per annum of purified potash, and 0.75 million tonnes of rock-salt.

The Dark Matter Laboratory

We did not visit the University of Sheffield's Dark Matter Laboratory, near pit-bottom. Here, scientists are attempting to detect WIMPs or Weakly Interacting Massive Particles. Such a deep mine allows the observations to be made without interference from cosmic and other rays and particles which are filtered out by over a kilometre thickness of rock.

Acknowledgements and thanks

We are grateful to Neil Rowley, a mining engineer at Boulby, for giving up most of a day to explain and conduct us around the mine, and to Martin Dixon for arranging the visit.

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Lawford Heath No.8 Group Coventry ROC HQ

Visited November 6th 2007

Mark Dalton



External view of Bunker

This facility operated between 1963 and approximately 1992 when the end of the Cold War resulted in the stand down of the ROC. The site was briefly RGHQ 9.2 but this scheme came to nothing and the site was sold by auction in March 1994. Plans of the main office accommodation dated May 1995 show the site converted to a Laser Eye Surgery although it is unknown if this scheme went ahead. The site was then sold to Satellite Media Services (SMS) in 1997 and an extensive conversion of the office accommodation and site landscaping commenced.

At the time of the Sub Brit visit in December 2000 the former ROC bunker was being converted into a control centre by SMS. This conversion started later than the main site as apparently SMS did not buy the bunker until some time after the purchase of the office accommodation. The bunker was in excellent original condition when the conversion started although most of the ROC related equipment had been removed, apart from the map boards, prior to sale. Larger plant equipment, including the generators, was sold and remaining fittings and fixtures which were not required were buried on site.

In recent years there has been some doubt over the future of the site. However, it was bought by a Dutch satellite communications company towards the end of 2006 with the intention of retaining and expanding the original SMS 'Teleport' or 'Earth Station' concept. The new company will be called "SMS-Mach 6" from January 2008 and more details can be found at <http://www.mach-six.com>.

I was fortunate to obtain permission to photograph some of the site and facilities, although due to commercial security considerations access and photography in certain areas was not permitted.

ROC/UKWMO Office Block

The access to the site is via electronically controlled gates and a driveway leads up to the former ROC / UKWMO office block. This block was modified by SMS to include a new reception area which takes the form of a large porch structure protruding from the original building (the original main access doors were around the back of the building away from the road and are now no longer used). The block itself was extensively modified internally by SMS and is in the form of a 'T' shape with the reception at the head of the 'T'. To the left and right of reception are the main working offices. Also to the left is the canteen.

Moving through the central corridor there is an area for toilets and storage, this being the only largely unmodified area of the building. Rooms further down this corridor house a large amount of technical equipment which we did not enter. The corridor leads to the end of the accommodation block and into a purpose built glass walled corridor which links the office block with the old ROC bunker.

This corridor drops down away from the offices and leads into the bunker at the mid level where the wall has been cut through into the space where the sewage plant used to be. At this point there is a highly unusual decorative lighting and mirror feature which can't really be described with text alone!

Conversion of the ROC Bunker

Although the bunker is currently under-utilised it is well maintained and has the appearance throughout of a high end office block. There are false ceilings and excellent lighting and air conditioning in all rooms and there is no hint of its former purpose in the majority of these.

Entering the bunker at the mid level means that the first major room is the plant room. This is largely empty, as is the generator room beyond. The spine corridor runs as it would have but the toilets and dormitories have now been stripped out and the left hand wall remodelled into a curved form.

The kitchen and canteen are beyond the plant room on the right and again have been stripped and remodelled and are currently used as workshops. It is also possible that some partition walls have been put up in this area but it was not clear from the brief inspection time available.

The spine corridor would have originally ended at the emergency exit but due to the extreme nature of the remodelling of the bunker, daylight is now visible at the end of the corridor and in fact the corridor exits directly onto a patio area outside the building which has been created by removing the original earth mound.

Within the bunker the control room is the area which still most closely resembles the original layout with the balcony level being retained to overlook the lower level control area. The actual balcony itself has been updated to glass and chrome but the layout is similar to the original. The

triangulation annex on this level is still recognisable and is now used as a rest area with seating and a water cooler. The other interesting feature of this upstairs area is the framed selection of photos showing the bunker prior to, and during, the conversion.

Moving to the lower level of the control room it can be seen that the walls of the

original data centre have been removed and merged with the control room to form one large room on this lower level. Two 'command' chairs and computers now take centre stage in this space and face a huge monitor screen made up of 8 separate screens which cover a large part of one wall. The main impression of this whole control centre area is of a James Bond set! In fact I was even shown how the huge screen 'wall' could be rolled out into the room to gain access behind it.



Control Room

The links between lower, mid and upper levels within the bunker can all be made via the original stair wells. The upper level has also been remodelled. The tank room is now used for storage. The filter and radiator rooms now contain elements of the current air conditioning system and the decontamination suite is now used as a small workshop, with the door from the inner room back into the corridor having been filled in.

Future Usage

The bunker can now be exited into the grounds from the original upper level entrance / exit and also from the mid level spine corridor. The grounds themselves have been extensively re-modelled with various paths, streams and lakes having been created around the site. Many of these features are still unfinished and a lot of landscaping work is still ongoing. Areas behind the bunker and office block contain a range of satellite dishes and supporting equipment although these were not photographed for security reasons. At the rear of the site was a particularly interesting fenced compound which was a meteorological station still owned and operated by the Home Office – the last reminder of the site's former owners.

While there is little evidence of the ROC and U K W M O ' s operations at this site, the original internal layout of the bunker can still be determined and it is heartening to see that the site is to take on a new lease of life after a period of uncertainty.

My thanks to Steve May and all the staff at SMS-Mach 6 Lawford Heath for an excellent tour and for supporting

Sub Brit in the continued documentation of this site.

Important note: This site is a highly secure facility and SMS-Mach 6 have made it clear that further visits would not be welcome due to the increasing usage of the site and the commercially sensitive nature of the service they provide.

Pictures by Mark Dalton

Southern Water Emergency Control Centre at Twyford

Nick Catford



Entrance to the bunker

During the late 1980's Southern Water built three emergency control centres at Twyford (Hants Division), Brede (Sussex Division) and Chatham (Kent Division). The bunkers would have acted as communications centres for each division with dispersed teams of engineers at key depots and works in survivable locations. The communications centres were built to coordinate post attack repairs.

Southern Water had its own HF radio network and the Divisional Water Controller would have used this and the phone network, if still working, to coordinate supplies and repairs. They would also liaise with the water board liaison officers at District and County Controls. Prior to the construction of the bunkers, the Divisional Offices used basements or earthed windows in ground floor rooms. Each Division had a Civil Defence Depot with generators, pumps etc. available.

Twyford Site

Each of the three sites were different; the bunker at Twyford utilised approximately one third of disused covered reservoir that had been built in 1905 and decommissioned in 1962. The site was earmarked in 1977 for future conversion into a nuclear bunker by partitioning off part of the reservoir and building a series of rooms inside.

Construction started in 1988 and was completed in 1990 - after the end of the cold war. The bunker was totally self sufficient and designed to house 30 people for 60 days with its own standby generator and air conditioning plant complete with NBC filtration; dormitories were also

provided together with a kitchen and canteen. The use of a disused reservoir for an emergency control centre was not unique to Twyford. The Bristol Waterworks also adapted a covered reservoir at its site at Nettlebridge near Shepton Mallett. The bunker remained available for use until 1997 when it was deemed surplus to requirements and was stripped of most fixtures and fittings.

New Owners

After 1997 the bunker was leased by Southern Water to Chubb Information Security (CIS) which spent millions of pounds converting it into a secure data centre which came on line in January 2001 to give its e-business customers peace of mind in the security of its electronic transactions. The computer that issued certificates of digital authentication was housed inside a huge Chubb safe. In 2005 Chubb relocated and the bunker was leased to Symantec, one of the worlds leading internet security companies, well known for producing anti-virus software. Symantec planned to use the bunker as its European Security Operations Centre playing a key role in providing Symantec's global monitoring services and also supporting the company's European managed services customers.

The former southern water control room was refurbished as the heart of the new facility housing six security analysts - part of the Symantec team of 25 staff. Each analyst worked a twelve hour shift, starting at 7am or 7pm. They sat at two screens used for research, monitoring and internal and external communications. The screens gave an overview of current internet

vulnerabilities. In June 2007 Symantec announced that it had outgrown its Twyford bunker and had relocated UK SOC operations to its new Reading HQ site and the bunker was put on the market by Southern Water.

Sub Brit Visit

Sub Brit member Bill Ridgeway arranged a visit to the site on 21 July 2007 for 23 members of the Society. Our guide for the day was Gordon May who had worked at the site for 17 years, initially for Southern Water during the refurbishment of the reservoir as a protected communications facility. He later stayed on as a caretaker and maintenance engineer working for Chubb and then Symantec.

Externally there is little to indicate what now lies below ground as the site still looks like a covered reservoir. There is an emergency access hatch on top of the mound and two small ventilation stacks at the far end; the main access is through an air lock on the far side of the mounded reservoir and not visible from the road.

The airlock consists of two heavy steel and concrete blast doors which lead to the former decontamination area; the showers have now been removed. Opposite the showers another heavy blast door leads into the standby generator room which is unchanged from Southern Water days. Beyond the decontamination area a short corridor leads through a reception room into a corridor that runs round three sides of the Security Operations Centre. To the left is a second plant room with new electrical switchgear and the original air conditioning and filtration plant and beyond this a meeting room. Turning right out of the reception room are the kitchen and office and towards the rear of the bunker the IT communications room.

Beyond this there was a further blast door into the remaining larger part of the reservoir. At some point an additional room has been added onto the back of the

refurbished area, rather than remove the blast door it has been left open and a new partition built round it with one half of the blast door in a new section of corridor and the other half of the blast door in the new room which was used by Symantec as its SOC communications room. At the end of the new corridor there is a door into the reservoir. At the far end of the reservoir metal steps lead up to the emergency exit hatch in the roof of the reservoir.

At the time of writing (November 2007) the bunker has not been sold. The original asking price was £300,000 but when offered for sale by auction the winning bid was £600,000 but this was subsequently withdrawn. The bunker is due to be offered for sale by auction again in the near future.

Only the Twyford bunker is being sold by Southern Water; the bunker at Brede is within the Brede Waterworks and is occasionally open to the public on open days at the waterworks. The bunker at Chatham is currently derelict and unused.

This visit was one of few to a clean, nicely decorated bunker with no dampness or musty smell and tea and coffee available on demand for free.

Several members went on to lunch in the local pub before going on to visit the nearby Twyford Waterworks Museum where we were made most welcome, split into three groups and given an extensive tour.

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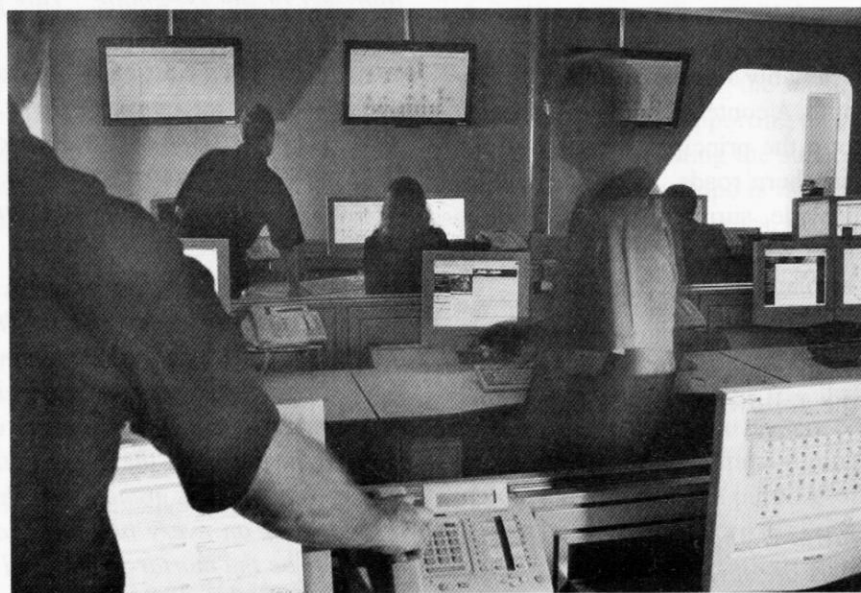
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Turner & Partners (Estate Agents)

Pictures by Nick Catford



Symantec Security Operations Centre located in the old Southern Water Control Room

Highgate Archway (1809 – 1812), London, and its place in road tunnelling history

Paul W. Sowan

Archway Road, forming part of the London end of the A1, is crossed by Hornsey Lane on an overbridge. The cutting here is the location of what would, if successfully completed, have been Britain's first public road tunnel, first proposed in 1809. The mining engineer Robert Vazie had submitted plans for this to Parliament in that year. By 1811 there was evidently some unease concerning the stability of the brick-lined excavation through London Clay, and despite the suggestion of John Rennie in December that year, the tunnel collapsed before completion, on 13th April 1812, fortunately without loss of life.

Early road tunnel proposals

Curiously, some of the earliest road tunnelling proposals were, ambitiously, for under-river works, such as those of Ralph Dodd [1756 – 1822] in 1798 for a tunnel below the Thames from Gravesend (Kent) to Tilbury (Essex). A shaft is believed to have been sunk on the Kent bank, but work was then abandoned. It is likely that shaft-sinking and tunnel-driving through water-logged fissured chalk was too great a challenge. Dodd also proposed a road tunnel under the Tyne, near Newcastle!

Richard Trevithick [1771 – 1833] made a heavily timbered pilot tunnel (referred to as the Thames archway or driftway) just large enough for the tunnellers to work in, almost from one bank of the Thames to the other in London in 1805 - 1808. It was intended to be widened out to a full size road tunnel, but never completed even as a pilot. Keith Walker (2000) has put on record an abortive attempt to tunnel under the Severn: 226 yards only were completed, in 1811 – 1812.

The Highgate tunnel

The 'corner-stone' (presumably at one of the portals) was laid by one Edward Smith. A contemporary report noted that 'This arch will form the principal entrance to the metropolis, from the northern roads, [and] is to be 36 feet high, and 18 feet wide, surmounted by a bridge traversing the valley, over which the Hornsey road is to pass. The valley is to be planted on each side.'

There was, by 1811, evidently some anxiety about the stability of the tunnel, as the engineer John Rennie [1761 – 1821] submitted the following report dated 27th December that year:

GENTLEMEN,

I examined the Archway at Highgate on Saturday last, and it appears to me there are several parts of the Work which may be altered with much advantage to render

the stability more certain, and the works more perfect than they will be if the present mode of execution is adhered to.

First. On examining the arch already finished, there are two places in which a weakness appears: first, in the upper part of the arch, between the top and side; and in the inverted arch, about three feet from the junction with the side arch.

Second. The manner in which the bricks are laid, and the bonding of the work together.

Third. The dimensions of the cast-iron skewplate.

Fourth. The mode of proceeding to the south, in the progress of the work.

Lastly. The kind of mortar which ought to be used in the brickwork.

As to the first.- It is quite clear to me that, owing to the swelling of the clay, the whole of the ellipsis is very much compressed; but the upper part, being more curved, is better able to resist that great pressure than any of the other parts; and, therefore, the clay that rests thereon being unable to push it down, slips off a little on each side, and the flat part between the top and sides is thereby charged with this additional load, and yields a little. To prevent this, I advise that in forming the centre this part should be curved about an inch and a half more in proportion than the rest, so that when compressed by the incumbent weight it will come to the form I have drawn it.

In like manner the inverted arch yields, within three or four feet of the skewplate. This part should also be increased in its curvation about two inches or two inches and a half, when first built, so that by compression it will come to what I have drawn it. The inverted arch need not be more than eighteen inches thick in the middle, but it should gradually increase to two-and-half bricks as it approaches the skewplates, and continue so to the said plates.

The manner in which the bricks are laid in the arch is by no means calculated to produce the greatest strength; for, as the radius of curvature increases the width of the brickwork at the outside, unless the bricks were radiated they would not bend in the extrados and intrados equally to resist the pressure: the length of the extrados towards the top of the arch is greater than the intrados, by about three inches on every two feet; so much thicker will therefore be the mortar-joints; and mortar, being more compressible than the bricks, when green will yield in proportion. The arch should, therefore, be laid in single

rows throughout the whole thickness, until the length in the extrados (or outside) admits of one brick in thickness being inserted there; at which place or places the bricks should be laid lengthways, to bind the different rings together; and so continuing round the whole. By this mode the arch will be equally solid throughout, and the immense pressure which is now exerted on the intrados (or inside), so as to flush the bricks, will thereby be avoided: and very great care should be taken in making the whole brickwork solid, with as thin joints as it is possible, to make them lie fair in each other.

Third. The cast-iron skewplates should be made the whole breadth of the joint between the inverted and side arch. This was so represented, in stone, in the section I made.

Fourth. It would not be advisable to proceed southward with the present arch until the water has been thoroughly drained off. For this purpose, two new pits should be sunk; and the work carried on from these to a junction with the present work.

Lastly. For nine inches from the extrados (or outside) the cement should be all Roman cement, of the best quality:- from thence to the intrados it should be one part of Roman cement to one of lime, with the proportion of sand. Perhaps Mr. Charles Wyatt, the maker of Roman cement, may know better than me how much lime and sand the Roman cement will bear, as I have not been accustomed to use it mixed.

The extrados, or back of the arch, should have a good coat of Roman cement over it, to prevent the penetration of the water, and between the arch and what is cut out, clay should be rammed as hard as possible, so as to make the action as nearly equal as may be.

In addition to the queries which I understand were put distinctly to me by the Committee, I must beg leave to remark, that when I gave the thickness of the brickwork in my section, it was expressly understood that that was the least thickness which ought to be given on the supposition that the clay was perfectly firm and hard where such arch was to be made, but whenever the clay is deficient, and does not answer the description, an additional thickness was to be given, and this at the discretion of the Superintendent, as the nature of the clay should appear - some places will require to be made 2° bricks, some 3, others 3°, and perhaps some may even require 4 bricks. This, however, can only be ascertained by careful examination; the Superintendent should be attentive, and decide with judgement; on which decision the success of the work will in a great measure depend.

I am, Gentlemen, Your most humble Servant,

JOHN RENNIE

To the Committee of Management of the Highgate Archway

The collapse

The works collapsed before completion, providentially very early on a Monday morning, before the tunnellers had commenced work. The whole site was then dug out to form an open cutting, and a bridge designed by the architect John Nash [1752 - 1835] constructed to carry Hornsey Lane. A contemporary report of the incident runs as follows:

Between four and five o'clock this morning [Monday 13 April 1812] the Highgate Tunnel fell in, with a tremendous crash, and the labour of several months was, in a few moments, converted into a heap of ruins. Some of the workmen, who were coming to resume their daily labour, described the noise that preceded it like that of distant thunder. It was the Crown arch, near the Hornsey-lane, that first gave way, and the lane, in consequence, fell some feet deep, and instantly became impassable. The houses in the vicinity felt the fall like the shock of an earthquake. The falling-in of the archway had been anticipated by the workmen for nearly a fortnight previous to the catastrophe, and is considered to have originated in too economical a regard to the quantity of bricks used in the arch, and the quality of the cement for uniting them having been deteriorated by too great a proportion of sand and lime. The number of persons whom the fineness of the weather attracted on the Sunday before, to inspect the works, were not less than 800. How providential that the fall was reserved for a moment when no person was on the spot! This accident, though a partial evil, will be evidently a public advantage, since it is now wisely determined by the proprietors to reduce their tenebrious [tenebrious = altered] tunnel to an arch of about 30 feet in length, which will be under and will support Hornsey-lane.

Conybeare and Phillips (1822) commented that 'The first attempt at Highgate was to drive a tunnel (like that of Pausillipo) through the hill; but after a tunnel of small dimensions had been driven, this plan was abandoned in consequence of finding the substratum sandy and loose, and incapable of supporting an arch of the dimensions required, and resisting the superincumbent and lateral pressure ...' Pausillipo is the best-known ancient road tunnel, just outside Naples, made in Roman times.

In 1844 Frederick Walter Simms [1803 – 1864] recorded in his pioneering treatise on tunnelling the following comments on the ill-fated 'Highgate Archway' as follows:

It will probably be in the recollection of many persons living, that, early in the present century, an attempt was made to construct a tunnel through the London Clay at Highgate Hill, for the purpose of making a more easy communication between Holloway and Finchley. The attempt, however, failed; and the result was the construction of the open cutting, which forms the present Highgate Archway road. The failure appears to have



arisen in a great measure from the want of experience on the part of the Engineers who had charge of the work, more especially as they had such very difficult and heavy ground to work in the London Clay. Those who have witnessed the trouble and difficulty that has been recently experienced in working in that treacherous soil will be less surprised at a failure in such a work thirty years ago.

In the year 1811, while the works at Highgate were progressing, the Committee of Management thought it necessary to obtain the opinion of the late John Rennie, Esq., as to the correctness of their mode of proceeding, as difficulties began to appear. That truly eminent Engineer examined and reported upon the works, which report the author has much pleasure in communicating, not only because it will throw some light upon the probable cause of the failure of the work; but also it will dispel the erroneous opinion that too generally prevails, namely that Mr. Rennie was the Engineer to the said work; whereas the fact was otherwise. The author believes that Mr. Nash, the Architect, was the principal, and a Mr. Vazie, the resident Engineer. It may at the present day be a matter of surprise that an Architect should undertake the construction of a tunnel; but so late as August 17th, 1812, there appeared in the *Star*, a London newspaper, an advertisement from the Regent's Canal Company, addressed to "Architects and Engineers," offering a premium of fifty guineas for the best design for a tunnel that was to be made (and afterwards was made) under the town of Islington; in which advertisement it was stated that the Company were "anxious to have the best information which science and practice can afford on the subject."

It should be noted that the word 'archway' at the start of the 19th century could mean a tunnel as well an arched gateway or the like. The *Oxford English Dictionary* includes a definition as 'An arched or vaulted passage.' What later became better known as the Thames Tunnel was at first promoted by the Thames Archway Company. Archway Road, therefore, is named after the failed tunnel, not the replacement bridge designed by the architect John Nash [1752 - 1835].

After Highgate

Marc Isambard Brunel's Thames tunnel, envisaged as a vehicular road tunnel and made between 1824 and 1842, was never completed as intended, as the access ramps at each end for wheeled traffic were never made. It was used solely by pedestrians until taken over by the East London Railway in the 1860s. However, at Reigate, between 1820 and 1824, a short road tunnel (248 feet) was made through a dry sandstone hill, and this ranks as the British Isles' first successful tunnel on a road open (at the time on payment of tolls) to the public. The Reigate tunnel is now pedestrians-only, and Listed as of architectural or historical interest.

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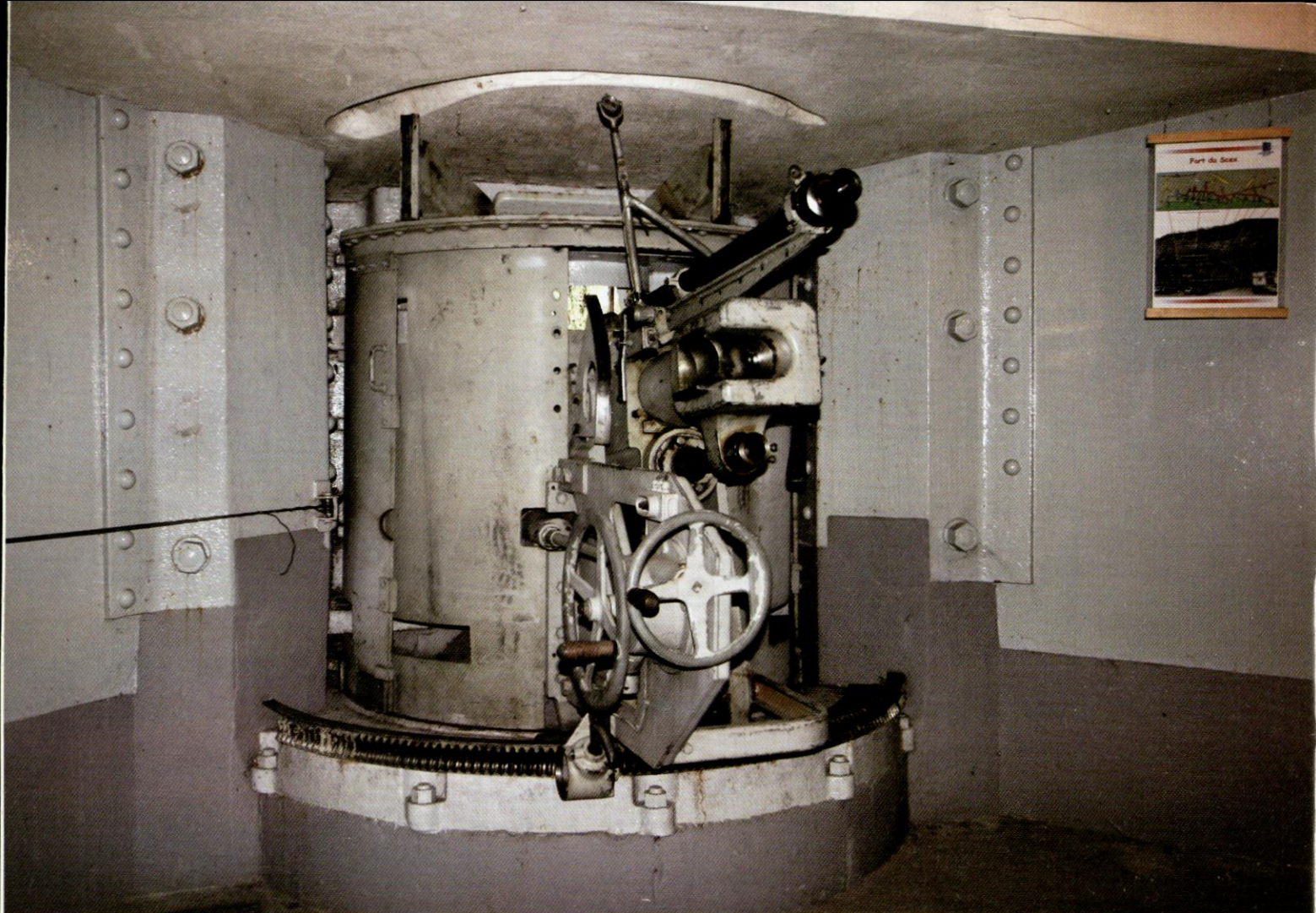
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СОБЕРИШКИ	ЧИСЛЕННЫЕ	ПОКАЗАТЕЛИ	ТЯЖИ	КОЭФФИЦИЕНТ	ПРОЦЕНТ
ИЗНАКОУШКИ	2 678	100			
СЕНТЯБРЬСКИ	129	34			
ДЕКАБРЬСКИ	118	3			
ФЕВРАЛЬСКИ	92	2			
МАРЬСКИ	72	2			
АПРЕЛЬСКИ	44	2			
ИЗНАКОУШКИ	120	100			
СЕНТЯБРЬСКИ	87	87,5			
ДЕКАБРЬСКИ	15	12,5			
ФЕВРАЛЬСКИ	11	9			
МАРЬСКИ	3	2,5			
АПРЕЛЬСКИ	6	5,0			
МАРЬСКИ	4	4			
ИЗНАКОУШКИ	2 645	98			
СЕНТЯБРЬСКИ	804	98			
ДЕКАБРЬСКИ	126	97			
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СЕНТЯБРЬСКИ	127	98			
ДЕКАБРЬСКИ	116	99			
ФЕВРАЛЬСКИ	92	100			
МАРЬСКИ	71	99			
АПРЕЛЬСКИ	43	98			

АСТРОНОМИЧЕСКОЕ ВРЕМЯ

КАТЕГОРИИ	КОЭФФИЦИЕНТ	ПРОЦЕНТ
ИЗНАКОУШКИ	100	100
СЕНТЯБРЬСКИ	100	100
ДЕКАБРЬСКИ	100	100
ФЕВРАЛЬСКИ	100	100
МАРЬСКИ	100	100
АПРЕЛЬСКИ	100	100
МАРЬСКИ	100	100
ИЗНАКОУШКИ	100	100
СЕНТЯБРЬСКИ	100	100
ДЕКАБРЬСКИ	100	100
ФЕВРАЛЬСКИ	100	100
МАРЬСКИ	100	100
АПРЕЛЬСКИ	100	100
МАРЬСКИ	100	100

